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By Edward Hodges Robie

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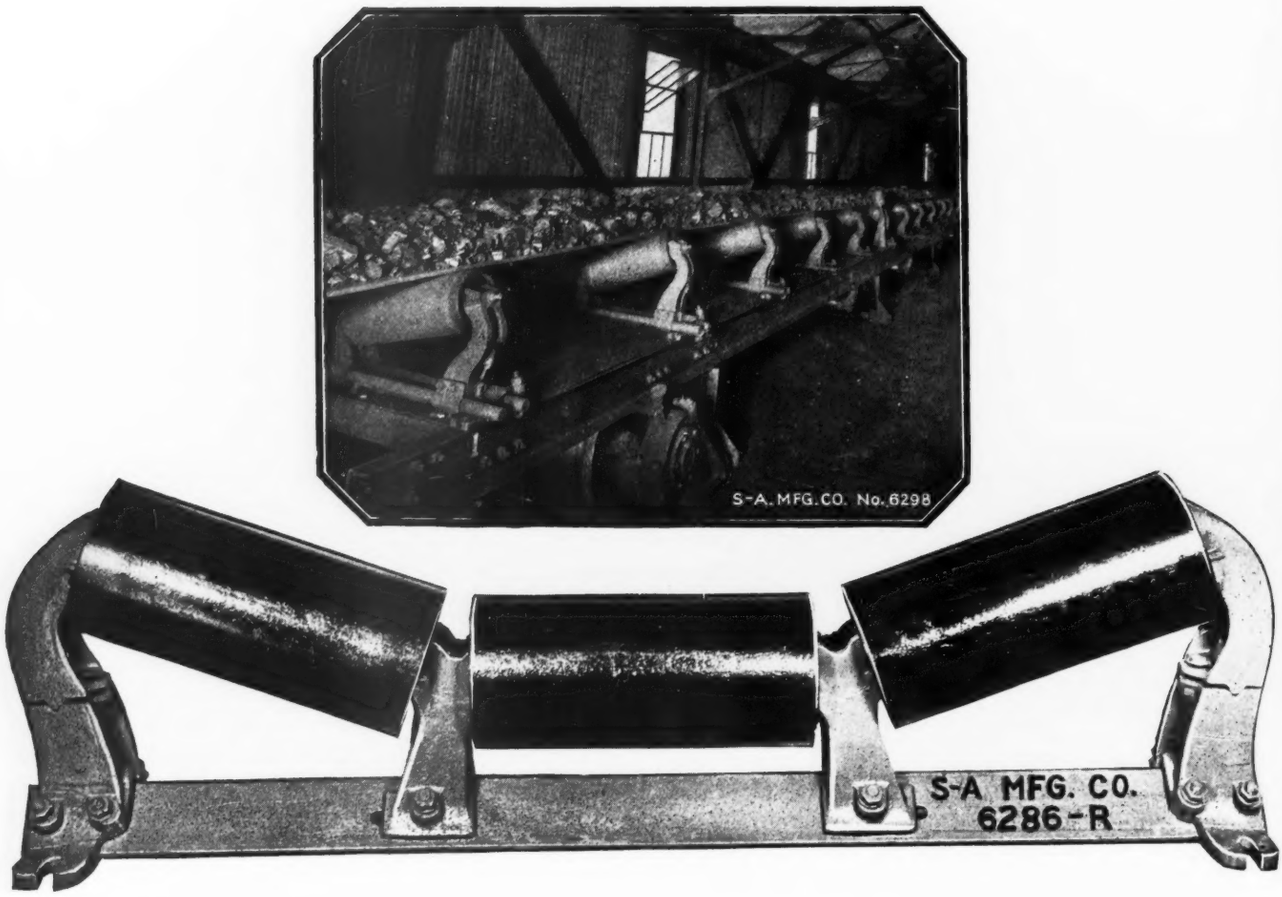

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ENGINEERING AND MINING JOURNAL

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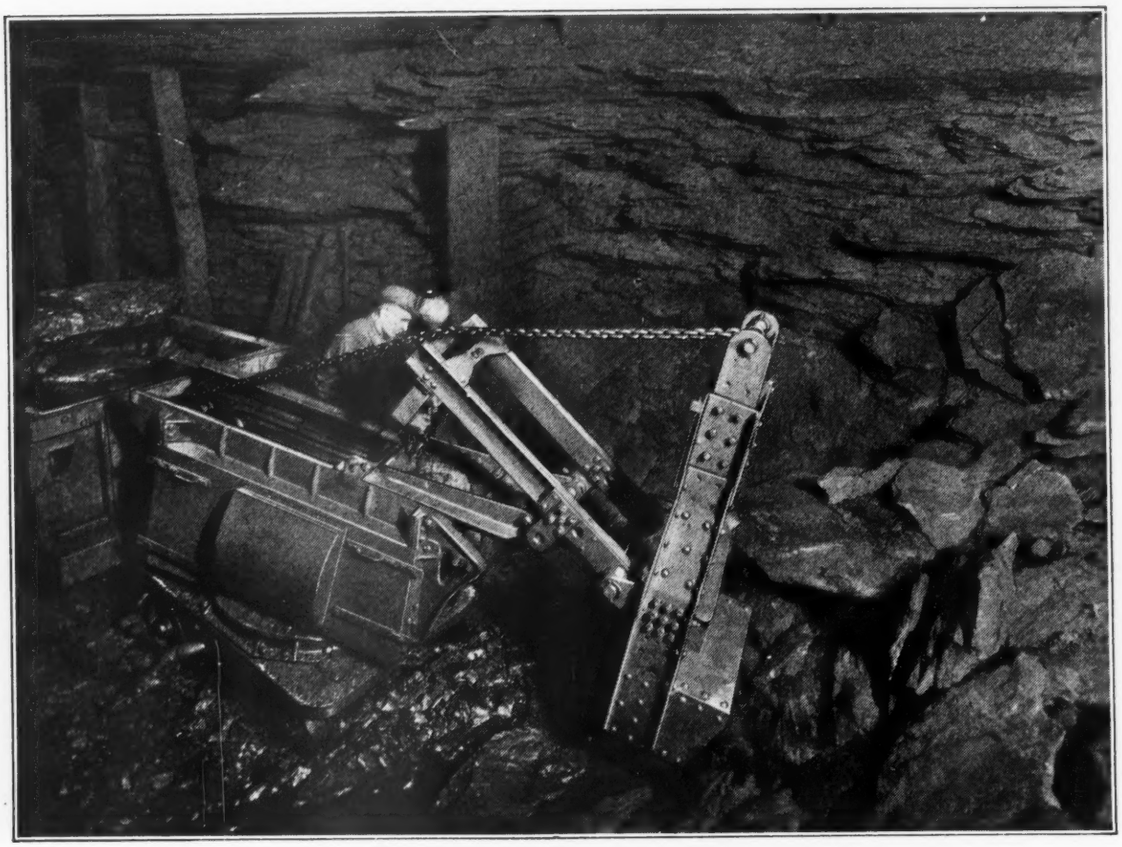

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ENGINEERING AND
MINING JOURNAL

JOSIAH EDWARD SPURR, Editor

Volume 122 | New York, October 9, 1926 | *Number* 15

Speaking of Tin

THE RECENT RISE in the quotations for tin to a post-war high record price of 71c. per pound has focused attention on the mining situation. This interest has been roused even in the United States, in which ordinarily the subject of tin receives scant attention, it being popularly regarded simply as one of those substances, like jute and coffee, which are imported from abroad, "from foreign parts," which produce from the jungles a mysterious and unlimited supply. Yet the United States, consumer at present of 70 per cent of the world's tin production, and producer of practically none at all, is vitally interested in this tin question; and one or more of the great American mining companies is also interested in the business of mining tin, in Bolivia and in the Federated Malay States. Of all countries, America is the home of the "tin can"—the tin-plated container which is so extensively used to preserve food, and as a commercial packet for marketing thousands of articles.

Some 70 per cent of the world's supply of tin has been derived from placer deposits, worked by means of dredges, gravel pumps, and similar devices. The greatest source of placer tin has been the Federated Malay States; the most important source of lode tin has been Bolivia. Production from the former has been slightly decreasing, when considered over a period of years, while that from the latter has been increasing somewhat. The total production (and consumption) of the world has been static or slightly decreasing over a number of years, being not far above or below 130,000 metric tons between 1913 and 1918, a figure which had shrunk to around 120,000 tons in 1925, while world consumption for 1925 was several thousand tons larger, reducing considerably the stocks on hand. The proportion of the world's tin consumption taken by the United States has increased from around 50 per cent in 1913 to the figure given above, or 70 per cent, in 1925.

That the static or decreasing world consumption of tin, in striking contrast with the rapidly increasing consumption of most other industrial metals due to the growth of industrial civilization, has been the effect of natural scarcity is shown by the steady though irregular rise in tin prices, from around 14c. a pound in 1895 to 56c. a pound in 1925, and the present figure of around 70c. a pound—an increase of 400 per cent. In the same period lead has risen from around 3c. to around 9c., an increase of some 200 per cent; zinc from around 4c. to around 7½c., an increase of less than 100 per cent; quicksilver from around $40 per flask to around $90, an increase of over 100 per cent; silver has not essentially changed in price; while copper has changed from 11c. to 14c., an increase of only 27 per cent! These changes indicate that the problem of the world's supply of tin is the most acute among the commoner industrial metals. As the world's demand for all of these for industrial uses has been multiplying, it is indicated that the world's resources of copper are most elastic, while those of tin are most definitely and rigidly limited by natural law. The increased proportion of the world's tin consumption by the United States, while that of Europe has actually decreased, shows that the prosperous condition of the United States has enabled it to pay the heightened price, and outbid war-impoverished Europe. Nevertheless, the drawing upon tin stocks to meet this American demand in 1925 proves that the situation is likely to become still more acute. Placer deposits notoriously have a limited life. An experienced critic, writing in the *Straits Echo* in May, 1926, hazarded the estimate that the available gravel in the Straits Settlements could not last under the present rate of exploitation more than eleven years. "Before three years expire," he predicts, "there will be quite a number of dredges idle, the world's output of tin will probably be going down, and the price of tin will probably be going up." He directs attention to the lode possibilities of the Peninsula. In Bolivia, lode mining will be prosecuted more vigorously. The recent paper by F. R. Koeberlin, in *Engineering and Mining Journal*, has attracted much attention, indicating the possibility, in certain cases, of finding valuable tin ores in lodes where the outcrops are poor—a condition which he demonstrates has happened in some mines. Some placer mining will be done in Bolivia, but the total amount will probably not be great. It is highly improbable that any tin of consequence will be developed in North America. Africa remains as the "black hope"—Africa, which has successively produced astounding deposits of diamonds, gold, platinum, chrome, asbestos, and copper. From rumors and indications, hopefulness regarding the potentialities of Africa is warranted, although, with the exception of gold, whose ultimate magmatic origin in Africa is not clear, the other metals which have been discovered in such abundance are more characteristic of basic magmatic provinces, such as occur in Africa; while tin demands the full development of a siliceous magmatic province. But the Dark Continent has not yet shown all that it can do in the way of magmatic provinces.

Men of Iron

HEROISM AND ENDURANCE of the highest type ennoble the record of the rescue of forty-three iron miners entombed for five days in the G. Pabst iron mine, at Ironwood, Mich. Fiction, even, affords few parallels to the age-old drama of the mines and mining that the whole country watched with hope—and prayer—from Sept. 24 to Sept. 29, as the slow progress of the work of the rescuers was featured, from day to day, in the public press. That all of the men not

killed outright by the collapse of the shaft were found well and "on their legs," in the words of their captain, approaches the miraculous.

The news story of the happenings at Ironwood will be found on other pages of this issue. But it is meet that tribute here be paid to George Hawes, who for hours crawled over stone and mud from the twentieth level to the eighth—2,000 feet; to Oscar Olson, engineer, who was literally at his heels; to Captain Tom Trewartha (whose very name tells some of the story); to Dr. W. L. Maccani, the company physician; to Captain Gust Erickson, and to all the intrepid and indomitable forty-three, who calmly proceeded to make "tea" of the bark of mine timbers while men and machinery worked unceasingly to penetrate the fractured graywacke that cut the buried miners off from the world of light and life.

Not in vain does man strive to conquer nature. Mastery of the air, the sea, and the very substance of the earth itself begets a spirit and a will that triumphs and survives—and ever shall.

Executives and Profit Sharing

THE ONE-MAN GOVERNMENT, which appears to be prevalent and most effective in Europe at the present time, as in Italy, Spain, and Poland, and which from time to time shows tendencies of settling in the United States or certain parts thereof, is advocated for business by Mr. Piez, in a recent address. He believes evidently in the theory which has made certain cities discard the representative plan of government and hire a business manager with full powers. He says of business that it is "a conflict, and can't be run by a debating society. It needs power and authority vested in a single individual to run it profitably. Leadership must exist if success is to be achieved, and no board or committee can serve as a substitute for centralized executive direction under a competent individual.

"The successful man always has a big following; the successful industry built up and operated by its owner rarely has labor trouble. It doesn't have to use profit sharing or other schemes to insure co-operation. Liberal wages for work performed will insure that."

It is doubtful if this will be widely accepted as a balanced motto for progress. The intelligent lesser employee is as keen for something which he may earn, through furthering the earnings of the business, as is the intelligent major employee. Mr. Piez states that the responsibility for successful operation is now vested in executive individuals who are especially competent, although they are rarely heavily interested in the stock of the enterprise, and states that "as a rule they are on a salary basis, supplemented by a share of the profits." This contrasts abruptly with the earlier quotation that profit sharing is not necessary to insure co-operation. If the incentive works with the major executive, why not a little lower down and so on? Where is the fatal line to be drawn between the employee who responds to profit sharing and the more humble and presumably inferior employee that does not? "The difference between man and man," says Macaulay, "is by no means so great as the superstitious crowd imagine." To understand others it is usually not necessary to go further than to examine thoughtfully one's self; and business administration will be more and more successful as the Golden Rule is applied.

The Celebrities' Gallery

IT IS ENTIRELY AS AN ASIDE that we rise to protest against the embellishing of clubs, public buildings, and other places which we frequent, with huge oil portraits. Instead of walls which are restfully simple and pleasing as to color and design, or paintings which depict some intelligible or worthy act or scene, the living mortal's gaze is oppressed with rows of these gigantic and unaesthetic effigies, with painful unchanging posture, grim mouths, and fixed eyes. Unless they bear labels, it is difficult or impossible to find anyone who can identify them; and if they bear labels, this often does not carry further knowledge or pleasure into the heart of the gazer. With dignified sideburns, with walrus mustaches, with imposing watch chains, with features which might have been looked upon with pleasure by some fond woman in their youth, but not now, they dominate the vista and subtly disturb the peace of mind of those who come within the compass of their reproachful glare—as weird a company as the old collection of tintypes in the plush album upon the black walnut table in the parlor with the haircloth furniture set therein. It is wonderful that no one ever reaches such a condition of respect or importance that his fellow men are tempted to hang his picture on a public wall, till all interest and expression except that of the saw, gimlet, and nut-cracker has fled from his pictured mug. We are indeed grateful to the multimillionaire who has given something in the way of a public building for us to enjoy, but why should we countenance the marring of its beauty by his colored likeness far larger than he ever desired to be, with unchanging shirt and necktie, and uncompromising fixity of eye? Possibly some mechanical device might lessen the unpleasant effect, so that the eyes of Andrew Carnegie, for example, would roll once in two minutes, and deliver a friendly wink every two minutes and a half; or the unknown gentleman with Dundrearies and hair parted in the middle, in the Yalevard Club, would once in so often raise that prominent right arm and insert between his teeth a comforting cigar. If they and the innocent bystanders cannot occasionally be given some such relief from the strain, they might be put in the attic every month for a week's vacation, and replaced meantime with flowers and vases.

Silver Drops

SILVER in New York dropped to 56⅞c. per ounce on Oct. 1 after a rather rapid decline from 66¼c. in mid-June. The average price for 1925 was 69.065c., somewhat higher than that of each of the four years immediately preceding. To just what extent each of several bearish factors have contributed to the decline is difficult to say. Some are inclined to take the view that the unfortunate conditions that have prevailed for many months in China are fundamentally responsible for the weakness. The developments of the last month, including the issuance of the report of the Indian Currency Commission, proposing the ultimate creation of a paper currency redeemable in gold, and the relegation of the silver rupee to serve as a medium for small transactions; and the suspension of the Russo-Asiatic Bank, once one of the greatest banking institutions in the Orient, they regard as merely having touched off the fuse.

Another view is that the underlying cause is the Currency Commission's report; that Chinese speculators have anticipated the tenor of the proposals contained in it, and that their position has caused selling in China. This in turn may have precipitated the difficulties of the Russo-Asiatic Bank. If the report of the Currency Commission is the prime factor, it is reassuring to observe the precautions that have been taken in the recommendations to make the transition as slow as possible. Obviously any action that would cause a material and permanent lowering of the value of silver would decrease the wealth of India as a nation and of the Indian people as individuals. The proposals are not to be submitted to the legislative body in India until next April.

In the meantime it is pertinent to examine the effect of a considerable drop in the price of silver on the mining industry. The estimated production of the world in 1925 was 241,575,000 oz. Of this total, the twenty-two companies listed in the accompanying table account for perhaps 65 per cent, after making allowance for the duplication that is involved in the figures given for the companies that smelt or refine for others.

Principal Silver Producers in 1925

	Company	Ounces
1	American S. & R.	82,223,189
2	United States S. R. & M.	24,157,057
3	Cerro de Pasco	15,941,000
4	Anaconda	9,050,836
5	Santa Gertrudis	7,606,609
6	Mexican Corp. (Fresnillo)	5,661,180
7	Burma Mines	5,131,539
8	Park Utah	4,815,002
9	Consolidated M. & S.	4,704,635
10	Tintic Standard	4,080,879
11	Mansfeld	2,909,028
12	San Rafael	2,875,881
13	Chief Consolidated	2,751,500
14	Tonopah Extension	2,725,298
15	Silver King Coalition	2,581,319
16	Premier	2,559,197
17	Tigre Mining	2,483,086
18	New York & Honduras	2,431,926
19	Nipissing	2,212,009
20	Butte & Superior	2,115,604
21	United Verde	2,108,348
22	Mining Corporation	2,032,105
	Total	193,157,227

By far the greater part of the 82,000,000 oz. credited to the American Smelting & Refining Co. is strictly custom intake, on which the miner bears the burden of any cut in the market price of the metal. Nevertheless, through its subsidiaries in Mexico, Peru, British Columbia, and Idaho, the Smelting company is a large producer of silver in its own right. One other possible effect on the business of the various smelting companies would be the curtailment in custom intake of silver, silver-lead, and silver-copper ores. Frequently ores classed as lead or copper are more valuable for their silver content than for the base metals.

The United States S. R. & M. Co. has a wide variety of sources of income. However, it produces more than half of the silver credited to it, from the great Real del Monte group in Pachuca, Mexico, where the ores are of the "straight" silver type. A difference of 10c. per ounce in the price of silver would mean a difference of a cool $1,300,000 in the annual income of the company.

The other companies in the list which produce typically silver ores are Santa Gertrudis, the Mexican Corporation, San Rafael, and Tigre in Mexico; Premier, Nipissing, and Mining Corporation in Canada; New York & Honduras, and Tonopah Extension. In the case of these gross income is directly proportional to the market price of silver, except for a little gold in some of the ores.

Silver is a very important element in the output of Cerro de Pasco, Anaconda, and United Verde, primarily copper producers. In the case of Cerro de Pasco, selection of ores makes it possible to stress production of either silver or copper. When smelter difficulties arose during 1925 the ratio of production was about 1 oz. of silver to 5 lb. of copper, but this was higher than normal. On the other hand, Cerro de Pasco is planning to begin the large-scale exploitation of huge reserves of low-grade silver ores lean in copper, and the market price of the former metal will be an important factor in earnings.

Anaconda's copper ores contain about 3 oz. of silver per ton. Accordingly a difference, in the disagreeable direction, of 10c. per ounce in the price of silver would be equivalent to an increase in costs of about 30c. per ton of ore, or of, say, 35c. per pound of copper. Burma Mines, Park Utah, Consolidated M. & S., Butte & Superior and Chief Consolidated are in somewhat the same position as the coppers, except that lead and zinc are the base metals for which the ores are primarily mined. With the other Utah companies, Tintic Standard and Silver King Coalition, zinc is of little importance, but lead brings more income than silver. All these obviously will feel a lower price for silver in some degree.

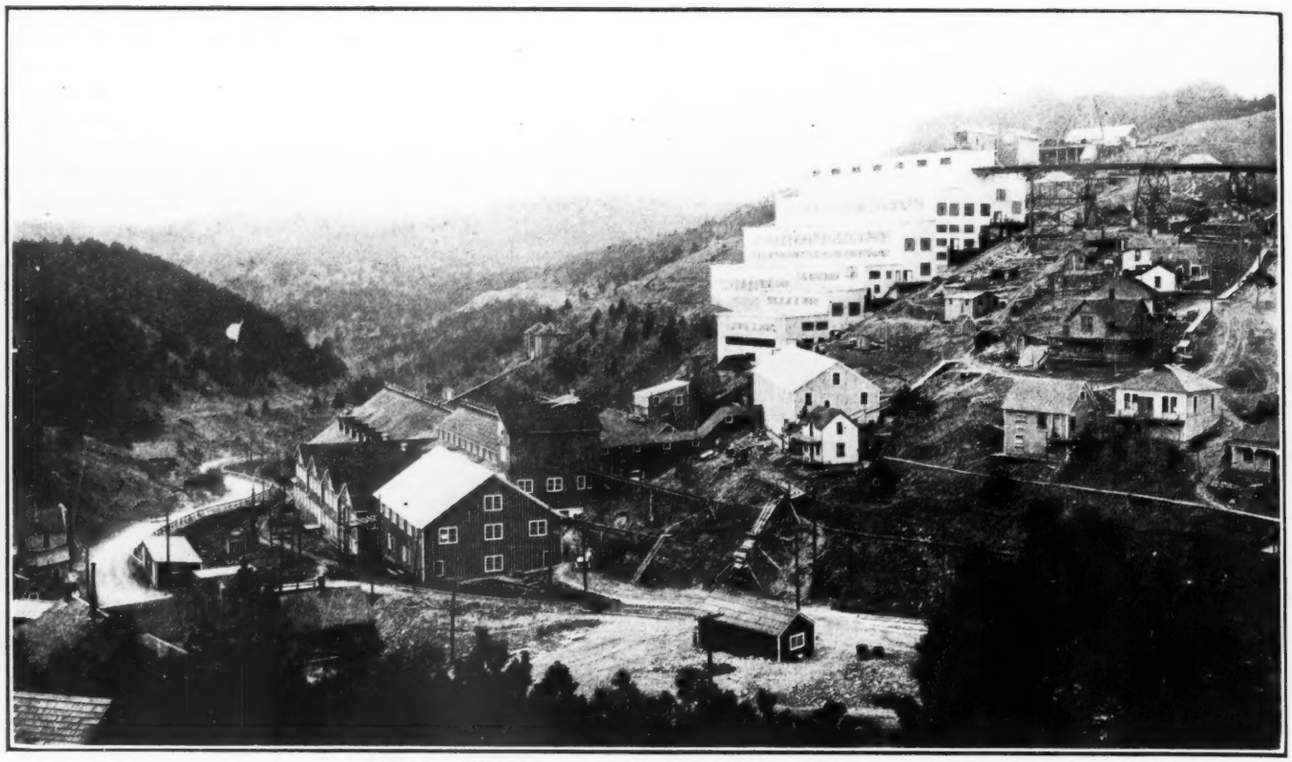
Engineering and Mining Journal is not prophesying that silver is going to range between 55 and 60c. per oz., during the next year, or the next few years. The average may be higher; and it is possible that it will be lower. Earnings, particularly of the "straight" silver producers, necessarily are affected directly by the price of silver; but no serious difference in the scale of mining operations is to be anticipated unless the price drops still farther and stays down.

Engineer Gold Subsides

RECENT QUOTATIONS of the stock of Engineer Gold Mines, Ltd., on the New York Curb recall the editorial mention this company received in these columns a year or so ago. It was then pointed out that at the high quotation of $109.50 of July, 1925, this property was valued at about $22,000,000, the ridiculousness of which was made evident by comparison with the value of other and considerably more famous, if not more notorious, gold mines. Those who were anxious to buy the stock last year but found the price a little high, can now provide themselves with all they want at about $5.50 per share. The mine is probably just as good as it was then, and the mill has had a thorough try-out by this time.

European Steel Cartel

THE ANTICIPATED STEEL COMBINE of France, Germany, Belgium, and Luxemburg has become a fact. The relative production of steel in all these countries has been definitely agreed upon. Competition between the subscribing partners will thus be eliminated, the amount of stocks carried reduced, and periods of undue activity or idleness decreased. It is hoped by this international cartel that other European countries which have steel industries will enter, making an all-European cartel. However, the preponderating importance of the industries already thus affiliated guarantees unified control of the world's second greatest steel-producing region.



South stamp mill on the hillside, with No. 1 sand plant below. The road to Deadwood and to the railway junction is at the left

Milling Practice at the Homestake Gold Mine

Metallurgical Data on Stamp Crushing, Grinding, and Amalgamating in the South Mill

By Edward Hodges Robie
Assistant Editor

THE HOMESTAKE is one of the famous gold mines of the world, with a reputation for the immense tonnage of ore that it has produced, for its conservative and efficient management, for its mining and metallurgical practice, and for its long record of dividends, extending back, almost without interruption, to January, 1879. Unlike the famous mines of the Rand or of northern Ontario, it is the only operating mine in the district in which it is situated; in fact, it is the only mine of importance in the state of South Dakota. It is, therefore, somewhat off the beaten track of the itinerant mining engineer, though easily reached by rail or motor; the transcontinental motorist will find the Black Hills picturesque and of historical interest, and a visit to Lead (pronounced Leed) and Deadwood, the seats of the Homestake activities, a pleasurable experience.

Metallurgically, Homestake is famous for its excellent cyanide and amalgamation practice, for its retention of stamps even in a recently constructed plant, and for its early adoption of rod mills. For many years, crushing at Lead was carried on in three plants, totalling 640 stamps of about 900 lb. falling weight each. About 1920 it became apparent that moving ground would force, sooner or later, the abandoning of two of these. One even then showed distortion and the other, although then sound (and, indeed, still standing) was over a large block of ore, the stoping of which could not be indefinitely deferred. It was therefore decided to replace these mills with a new structure and the South mill, placed in operation late in 1922, was the result. This mill, the joint design of R. G. Wayland and Allan J. Clark, was described by F. E. Wormser in the Oct. 21, 1922, issue of this magazine, when operation was just beginning. It has now been in operation for about four years and some of the details of its construction and operation, supplementing previously published data, may be of interest, even though no departures have been made from its original flow sheet and performance has accorded closely with expectations.

Allan J. Clark, who has been metallurgist of the company for more than twenty years, has published several excellent discussions of Homestake metallurgical practice and, since the more recent cyanide practice is substantially unchanged, that phase of the work will not be discussed here. Neither will the remodelling of the Amicus mill, which followed the completion of the South mill, inasmuch as this was largely a problem of local interest only, involving the rearrangement of old equipment to take advantage of the changed conditions brought about by the abandonment of the other plants.

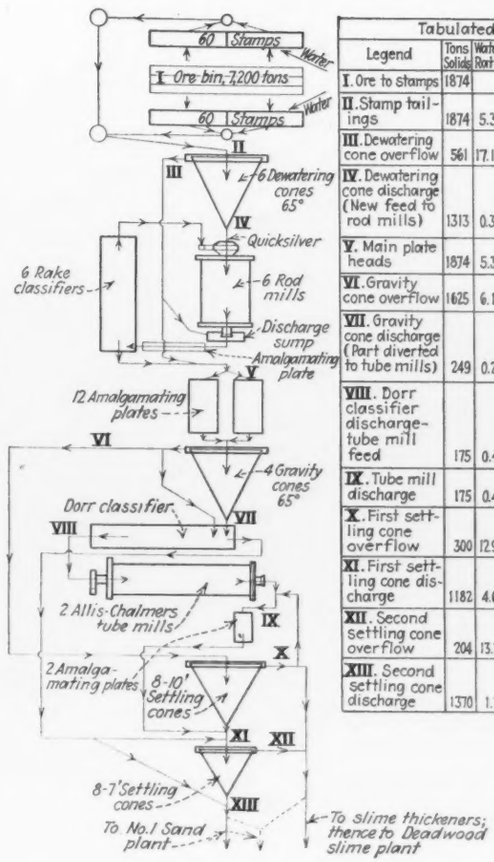
Upwards of 1,800 tons of ore is crushed and ground daily in the South mill. The rock is a hard silicified slate carrying finely disseminated free-milling gold,

with many associated minerals, chiefly pyrite, arsenopyrite, and hornblende. It is first crushed in stamp mills, then dewatered in cones, ground in rod mills followed by amalgamation, and finally the coarser sand is ground in tube mills. The pulp is then ready for cyanide treatment in separate plants.

Preliminary crushing underground to 6 in. in Traylor 36x48-in. jaw crushers is practiced, followed by reduction in three No. 6 Gates gyratories at the surface, set to 3 in. Bins for the gyratory product are provided at the hoists, from which the ore is removed to the mill bin in 4-ton cars, 30 cars to a train, hauled by compressed-air locomotives. The 7,200-ton bin discharges through suspended Hendy Challenge feeders to two rows of 60 stamps each situated on either side of the bin and parallel thereto. The stamp-mill feed really should be no larger than 1½ in. on the smallest dimension, but actually many pieces 2 to 3 in. in diameter are handled.

Five stamps are driven through one shaft by a 25-hp., 600-r.p.m. General Electric back-geared induction motor. The former practice was the usual one of driving ten stamps from one cam-shaft. The increase of the falling weight of the stamps from 900 to 1,550 lb. each made this impossible, if the old motors and belts were to be utilized. Precedent seemed to be the principal reason for the usual arrangement, so the change was made. No unfavorable conditions have been noted as a result; breakage is no greater and excessive vibration is not apparent.

A substantial foundation for the mortar block is, of course, an essential. This is of concrete of the following composition: 22½ cu.ft. of 2-in. crushed stone, 7 cu.ft. of ½-in. stone, 13 cu.ft. sand; and 450 lb. cement to each cubic yard of concrete. For a distance of 2 ft. directly under the mortar box, 700 lb. of cement was used, the other quantities remaining the same. The volume of each block is about 50 cu.yd. The top of the concrete is bush-hammered down to a smooth surface, on which is laid ½ in., 6-ply conveyor belting, surmounted by a 4-in. oak block and a ¾-in. rubber pad.



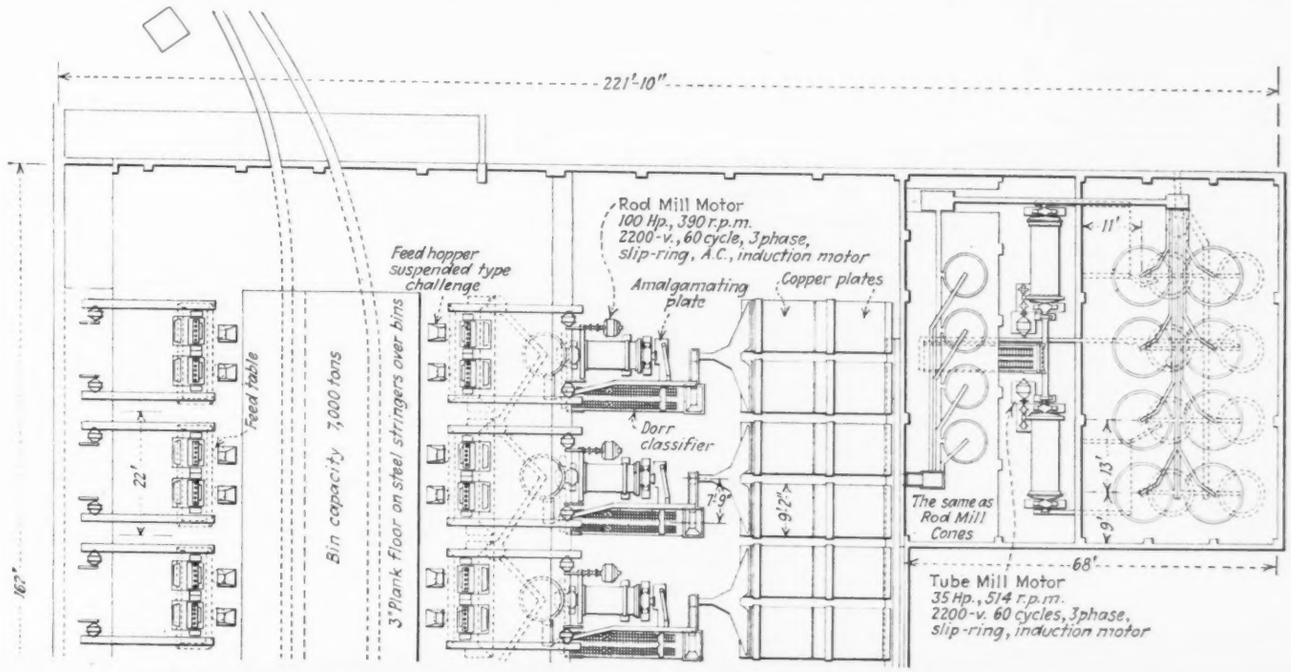
Tabulated Data

Legend	Tons Solids	Water Ratio	Assay Dollars	Mesh +50	-50+80	-80+100	-100+200	-200
I. Ore to stamps	1874		4.02					
II. Stamp tailings	1874	5.36	4.02	59	5	2	8	26
III. Dewatering cone overflow	561	17.10	1.63	1	1	1	21	76
IV. Dewatering cone discharge (New feed to rod mills)	1313	0.36	5.04	85	6	2	4	3
V. Main plate heads	1874	5.36	1.93	7	13	6	21	53
VI. Gravity cone overflow	1625	6.10	1.49	3	11	5	23	56
VII. Gravity cone discharge (Part diverted to tube mills)	249	0.26	2.51	27	34	8	16	15
VIII. Dorr classifier discharge-tube mill feed	175	0.43	2.62	41	40	6	8	5
IX. Tube mill discharge	175	0.43		6	20	9	26	39
X. First settling cone overflow	300	12.90	1.23	0	0	0	2	98
XI. First settling cone discharge	1182	4.60	1.54	5	13	6	31	45
XII. Second settling cone overflow	204	13.20	1.26	0	0	0	2	98
XIII. Second settling cone discharge	1370	1.75	1.75	4	15	6	28	47

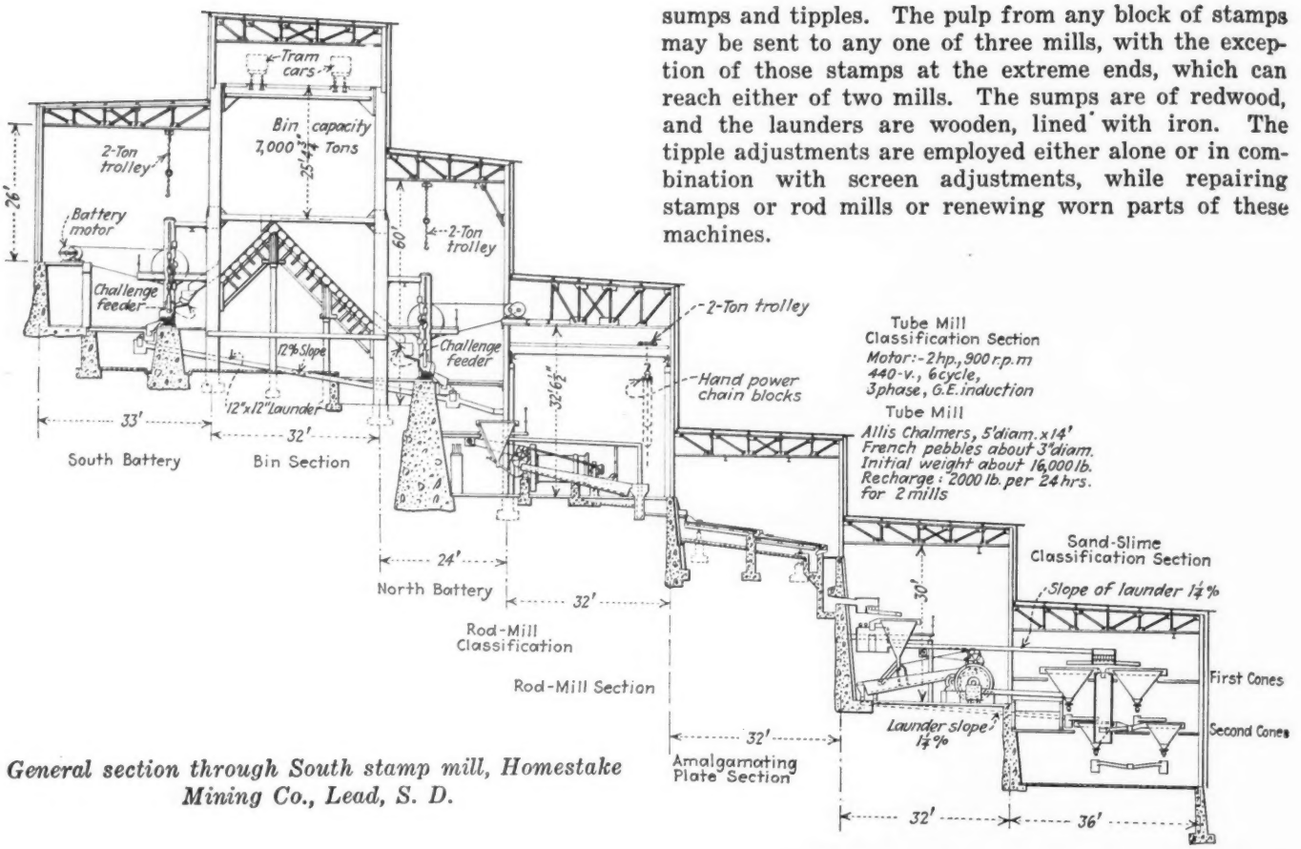
General metallurgical flow sheet, South stamp mill

Classification of sand and slime is completed in the No. 1 Sand plant in two more batteries of cones

The method of lubrication of the stamp-mill shafts and also of the rod-mill bearings is of interest. The bearings are open like the journal box on railroad cars and the working part is kept lubricated with felt pads, to which oil need only be applied at intervals of several hours. One man per shift, who would otherwise spend



Plan of the South stamp mill. Only one-half of bins and stamp- and rod-mill grinding units is shown, the other half being a duplicate



General section through South stamp mill, Homestake Mining Co., Lead, S. D.

most of his time wielding the oil can, has thus been displaced. This innovation is due to the co-operation of Mr. Hunter of the Texas Oil Co.

Battery Constructional Data

Stem: Mild steel, 4 in. diameter x 14 ft. long. Weight, 600 lb. Hammered iron is preferable, but the increasing disparity in price, compared with steel, has resulted in the substitution of the latter material for this as well as for several other parts.

Tappet: Cam and bosshead—chrome steel.

Shoe: Forged steel. Chilled white iron castings are suitable with 900-lb. stamps, but with increasing weight the forged steel shoe is preferable. At 1,050 lb. (the weight of the stamps in the remodeled Amicus mill) there is little to choose between the two materials.

Die: Hard white iron, 220 lb. The Homestake foundry is equipped to cast an excellent grade of this material. In several places it is superior, from the economic standpoint, to any other material, and it is largely used about the mills.

Mortar: These are locally cast, of white iron, and weigh 7,200 lb. They are provided with two liner plates of manganese steel, to absorb the wear at the feed end of the mortar. A built-up housing of sheet-iron and rubber belting is attached to the mortar and the battery-posts, confining the splash and making it possible to keep the mill clean.

Stamp Drop: 8 in., 100 drops per minute.

The screens are of various sizes, changed frequently to accord with variables such as the type and grade of ore and the number of rod mills in use. Grinding is finer the higher the grade of ore. In general the size varies between 2 and 3 mesh, or the equivalent screen with rectangular openings, though it is not often finer than 2½ mesh. This screen manipulation is the adjustment most frequently resorted to in controlling the feed to the rod mills. The cost of stamping in 1924 was 8.6c. per ton.

Extreme flexibility was sought between the stamps and rod mills, and was secured by a combination of sumps and tipples. The pulp from any block of stamps may be sent to any one of three mills, with the exception of those stamps at the extreme ends, which can reach either of two mills. The sumps are of redwood, and the launders are wooden, lined with iron. The tipple adjustments are employed either alone or in combination with screen adjustments, while repairing stamps or rod mills or renewing worn parts of these machines.

The stamp-mill product is dewatered in six cones, 7 ft. diameter x 7 ft. deep. From 10 to 35 per cent of the pulp is sufficiently fine not to require rod-mill grinding, being allowed to overflow these cones, and to go direct to the rod-mill classifiers. Each cone has an adjustable overflow weir and removal discharge bushings to make adjustment easy. As these cones discharge through a bushing of small diameter, there is danger of stoppage. To minimize the supervision necessary to avoid this, the discharge impinges on one end of an unbalanced rod which is mounted on a bearing attached to the discharge launder. The opposite and longer end of the rod projects about two feet beyond the back of the launder, and normally, when the sand is discharging, it is held in a position about 50 deg. above the horizontal. Should the flow cease, the rod falls to the horizontal. Thus a glance down the length of the mill discloses any irregularity of action.

The sand discharge from the cones is ground in six 5x10-ft. Allis-Chalmers rod mills direct-driven with a single reduction through herringbone gears from 100-hp. Allis-Chalmers motors. Each mill is in closed circuit with a 4 ft. 6 in. x 22 ft. 6 in. Dorr classifier. For the end liners of the mills, Allis-Chalmers special alloy steel or chrome steel is used; for the shell liners, both chrome and manganese steel have been used in the past, but the company is now definitely committed to white iron castings, made locally. The shorter wear and the extra labor of more frequent renewal is more than counterbalanced by their much lower cost. Liner consumption is about ⅓ lb. per ton, without allowance for scrap. A shell liner wears about seven months, and is replaced in eight hours. Discharge head liners outwear three sets of shell liners; feed heads outwear two discharge heads. The rods used are of 3-in. high carbon steel (0.9 per cent carbon), 9 ft. 11 in. long. The initial rod weight is 24,000 lb., and usually one

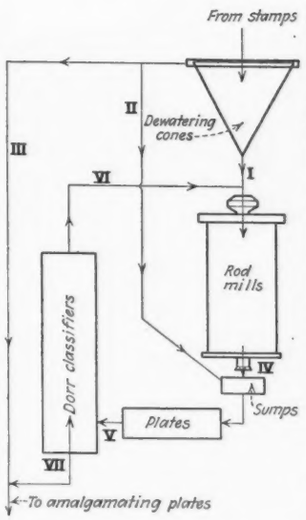
additional rod is inserted in 24 hours. Rod consumption is about 1.1 lb. per ton ground. No difficulty has even been experienced with twisted rods, and no worn rods are ever taken out; nor is there any tapering of the rod ends. Each mill is provided with two small jacks at the discharge end so that the mill can be elevated and the end taken off without discharging the contents.

The capacity of a rod mill depends largely on the fineness of feed; somewhat less on the desired fineness of product. Thus, in 1924 when a comparatively soft ore, much of it from draw holes, was milled, at the rate of 1,920 tons per day, coarse screens were used on the stamp batteries, and six rod mills were required, each mill grinding about 230 tons per day. In 1925 much harder ore was treated, at the rate of 1,800 tons per day; all the stamps were operated, with finer screens, and only five rod mills were required for the greater part of the time, each grinding about 245 tons per day.

The actual power consumption is 76 hp. per mill and the cost of rod-mill grinding about 11c. per ton thus ground, or 7.7c. per ton stamped. The mills run at 20 r.p.m.

After four years of continuous operation of the rod mills no weakness or fault has developed in them. It is considered that they perform better on a fairly fine feed, substantially such as is regularly supplied them; within this range they are efficient and dependable. The low cost of the grinding media is an important factor in the control of milling costs.

The proper dilution in the classifiers is obtained by diverting the needed amount of water from the dewatering cones, as already mentioned, the water being added at the rod-mill discharge where it serves to convey the thick pulp to the classifier. A density indicator similar to that described on p. 170 of the Jan. 24, 1925, issue of the *Engineering and Mining Journal-Press* is used, consisting simply of a bent glass tube, with its lower end vertically submerged in the pulp and held there by a clamp attached to the feed trough.



Tabulated Data

Legend	Tons Solids	Water Ratio	Assay Dollars	Mesh Sizings +50	+100	+200	-200
I. Dewatering cone discharge (New feed to rod mills)	1,313	0.36	5.04	85	6	2	4 3
II. Dewatering cone overflow A (Fraction used to dilute rod-mill discharge)	130	17.10	1.63	1	1	1	21 76
III. Do. B. Fraction bypassed around rod-mill circuit, to join Dorr Classifier overflow to flow over main amalgamating plates	431	–	–	–	–	–	– –
IV. Rod-mill discharge	4,207	0.32	*	47	19	5	11 18
V. Dorr Classifier feed	4,337	0.83	*	46	18	5	11 20
VI. Dorr Classifier return	2,894	0.30	*	75	19	4	6 6
VII. Dorr Classifier overflow. (Finished product from circuit)	1,443	1.87	2.01	9	17	7	20 47

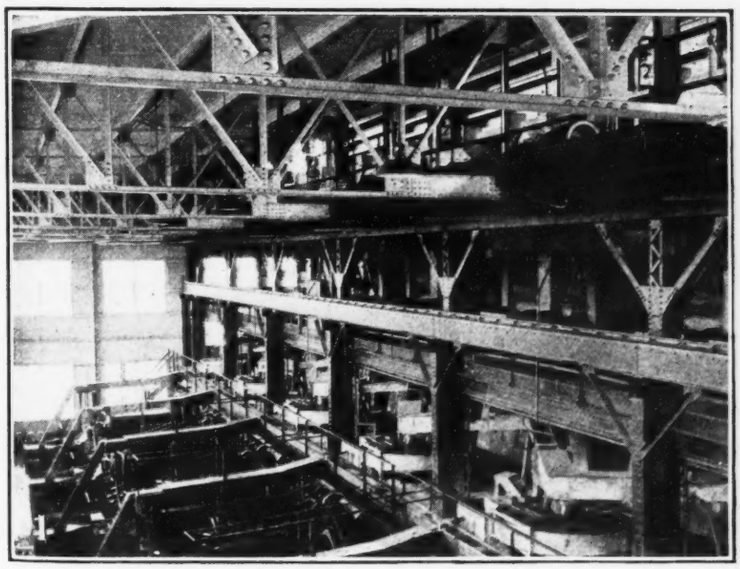
*Free gold makes assays of these products impossible. Calculated assay about ½ per ton

Calculated flow sheet about the rod-mill closed circuit

Sizings are calculated where positive measurements are not available

The distance that the settled clear water rises in the upper inclined portion of the tube indicates the density of the pulp in which the lower end is submerged, marks being placed on the outside of the glass to indicate the limits of density to be carried. This indicator was invented at the Homestake plant.

Quicksilver is fed to the rod mill in amount about equal to $\frac{1}{10}$ oz. troy to an ounce of gold in the rod-mill feed. The rod mill discharges into a shallow sump. The pulp is diluted with cone overflow water and then passes to the classifier through a launder in which is laid a replaceable copper plate, 1 ft. wide x 7 ft. long, plated with 2 oz. of silver per sq.ft. This plate is changed every four hours, by which time it is heavily coated with amalgam. The importance of this sump and small plate may be gathered from the fact that over 80 per cent of the total gold that is recovered by



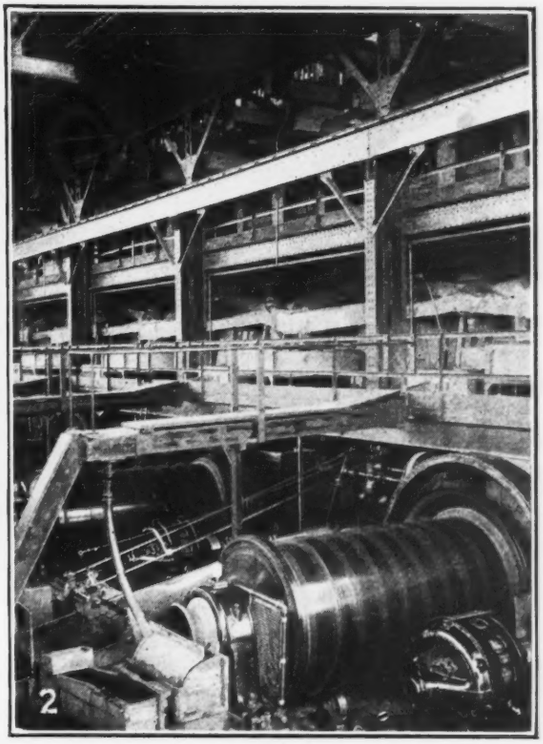


Fig. 1, above, shows the stamp mills, classifying cones, and the tops of the rod mills. Fig. 2, at the right, shows placement of the rod mills, drive motors, and discharge launders

amalgamation is obtained here, or about half the gold in the ore. The early removal of this coarse gold is considered to be one of the important details of the operations. The gold so recovered is won at a cost substantially less than that of pressing and refining an equally valuable weight of cyanide precipitate.

The classifier overflows pass over 48 large amalgamating plates, each being ¼ in. thick, 4½ ft. wide and 12 ft. long arranged in blocks of four each, making 12 amalgamating units each 9 ft. wide x 24 ft. long. The plates are sloped 1½ in. to the foot, though the inclination is adjustable by jacks at the upper end of the first set of plates and at the lower end of the second. They are arranged with measuring sumps and tipples for experimental work, when one rod-mill unit may be compared with one or all of the others. The plates are of copper, plated with 3 oz. of silver per square foot, and are cleaned and dressed once every 24 hours. The total recovery by amalgamation, including that between the rod mills and classifiers, is about 63 per cent, most of the balance of the gold being extracted in the cyanide plant. It is desired to amalgamate only the comparatively coarse gold particles, as there is no difficulty in the solution of —100-mesh particles of free gold in the cyanide treatment used in the successive plants.

All floors are of concrete, sloped to drain into sumps which serve to collect any quicksilver that may have gone astray. The sumps overflow into the tailing line. Their accumulated sand is cleaned up about twice a year.

To supplement the rod mills and to minimize the supervision required to operate them, provision is made for further grinding the coarser fraction of the amalgamation tailing. This smooths out daily irregularities in operation of the plant up to this point and makes for a more uniform average size in the cyanide plant feed. The cost of fine grinding and the additional recovery of gold thereby obtained, run very closely together on average Homestake ore. Fine grinding, say to —100 mesh, is certainly not warranted on surface, or oxidized ore of average grade, which is porous and yields its gold with no great difficulty. On ore from the deeper levels of the mine, however, a small profit may be made by finer grinding.

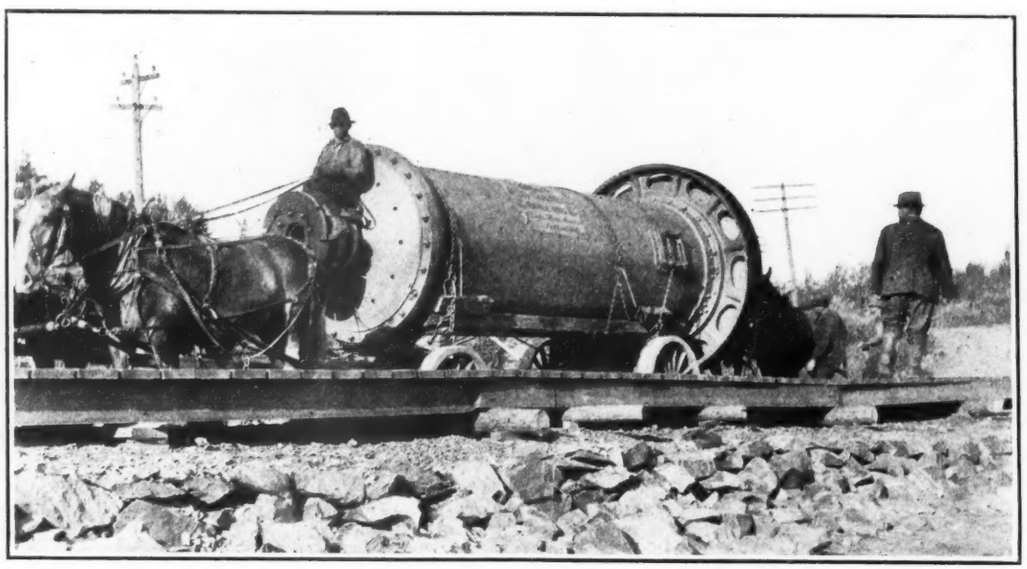
From the amalgamating plates, the pulp goes to four 7x7-ft. gravity cones, the spigot discharge from which goes to a 22½x4½-ft. Dorr classifier. The rake product is split between two Allis-Chalmers tube mills, 5x14 ft. These have ribbed liners of the El Oro type, French pebbles about 3 in. in diameter being used as the grinding media. The weight of the pebbles contained in each mill is about 16,000 lb., about 100 lb. being added each 24 hours that a mill is in operation.

The mills are in open circuit, the reground pulp passing over two 9x12-ft. amalgamating plates. A partial separation of sand and slime is then made in cones, the overflowing slime being dewatered in three 32x20-ft. Dorr tray thickeners, two with three decks and the other with two decks, thence passing to the Deadwood slime plant, about three miles away and at 1,000 ft. lower elevation, for treatment by cyanidation. The sandy discharge, still carrying some slime, flows to the adjoining cyanide plant No. 1, where classification is completed and cyanide leaching is carried out.

The South mill is particularly efficient in the item of labor, about 10 tons being milled per man-hour. This means a total labor cost of 4.8c. per ton. Total costs in the plant amount to 21.9c. per ton stamped, of which 8.6c. is allocated to the stamp mills and 7.7c. to the rod mills, as already mentioned.

The accompanying quantitative flow sheets represent a period of rather coarse grinding, at a time when the ore was derived largely from drawholes and was mostly though not entirely oxidized. They represent a condition where tonnage was being achieved by letting the rod-mill classifiers pass a considerable volume of coarse sand to the tube mills for finishing.

Warren H. Todd is foreman of the mill, which is under the supervision of Allan J. Clark, metallurgist, to whom I am indebted for the data herewith presented. The entire plant is a delight to the eye if not to the ear of the visitor, being one of the best designed and cleanest of any in the country.



A tube mill of similar type to those used at Homestake, being hauled to the Lake Shore mill, Kirkland Lake, Ont. A motor truck, not shown in the photograph, is really doing the pulling, the two teams helping to control the progress on hills.

Deepening the Pilares Shaft of Moctezuma Copper Company

Pilot Raises Driven from the 1,800, 1,700, and 1,600 Levels—Enlarged by Shrinkage Stoping—Total Cost $67.79 Per Foot

By E. Leland
Mine Superintendent, Moctezuma Copper Co., Nacozari, Sonora, Mexico

THE NEW Pilares shaft of the Moctezuma Copper Co., Pilares de Nacozari, Sonora, Mexico, is approximately 300 ft. outside the mineralized ore zone and is in latite breccia to a point below the 700 level. From this point down it is in andesite and andesite breccia, a solid uniform rock, but very blocky in places, so that when left unsupported it sloughs badly. This shaft now extends to the 1,800 level. The last 400 ft., from the 1,400 to 1,800 level, has just been completed.

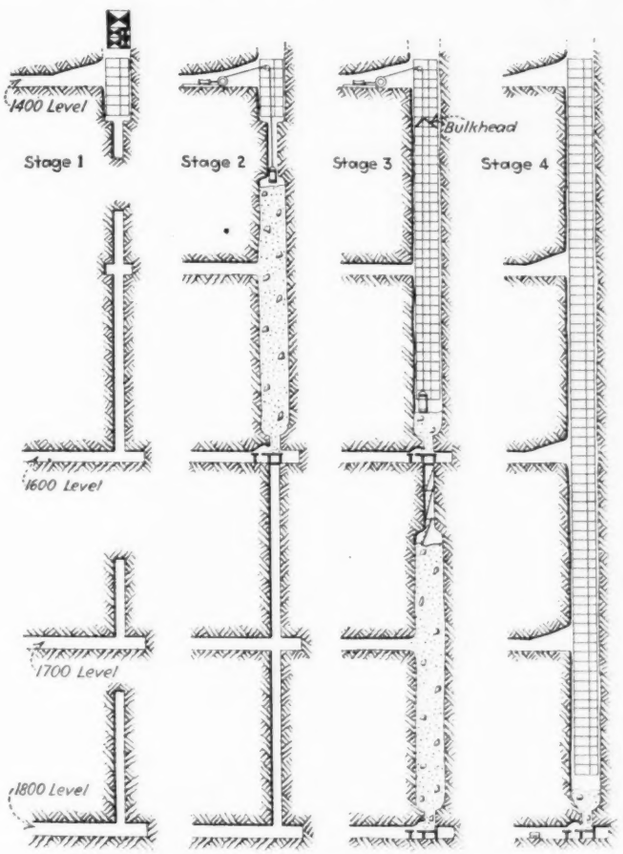


Fig. 1—Sketch showing various stages of Pilares shaft sinking

The Guadalupe shaft, near the center of the mineralized area, is the main hoisting and drainage shaft and has always been the pilot shaft. As each new level was opened up, main drifts were driven from the Guadalupe to the Pilares shaft and pilot raises driven from level to level. Formerly, after the pilot raise was driven, enlarging and timbering was started at the bottom and a lined chute carried in one of the shaft compartments for waste disposal. Some of the disadvantages of this method were the difficulty in handling the timber, the extra cost of the lined chute, and the necessity of breaking the rock rather fine for handling through the chute. This shaft was sunk by the method mentioned from the surface to the 1,400 level.

Early in 1924, when it was decided to extend this shaft to the 1,800 level, the following plan was adopted: A pilot raise, Fig. 1, 4x7 ft. in section, was driven as closely as possible in the center of the shaft location from the 1,800 and from the 1,600 levels, to the bottom of the sump 35 ft. below the 1,400 level. The 1,800 raise connected with the drift on the 1,700 level, continuing on to the 1,600 level. The raise from the 1,600 level connected with the sump below the 1,400 level, a distance of 167 ft.

On the completion of the pilot raise, a shrinkage stope was started 20 ft. above the 1,600 level, as near 12x20 ft. in section as possible, to accommodate the shaft timbers, which require an over-all space of 11x19 ft. A shrinkage stope shovelway, Fig. 2, was built on the 1,600 level so arranged that the raise from below was left open and protected. All the over-break was drawn off through the "Chinaman chute" shovelway as the shrinkage operation progressed. The same procedure was carried on with the section between the 1,800 and 1,600 levels.

Bulkheads Used for Safety

After breaking through with the shrinkage into the bottom of the shaft, and prior to starting of timbering, it was necessary to protect the workmen from possible accidents and falling material in the operating section of the shaft between the surface and the 1,400 level. A solid bulkhead was placed just below the 1,400 level in the main hoisting compartment, A, Fig. 3, the counterweight compartment, D, and hoisting compartment,

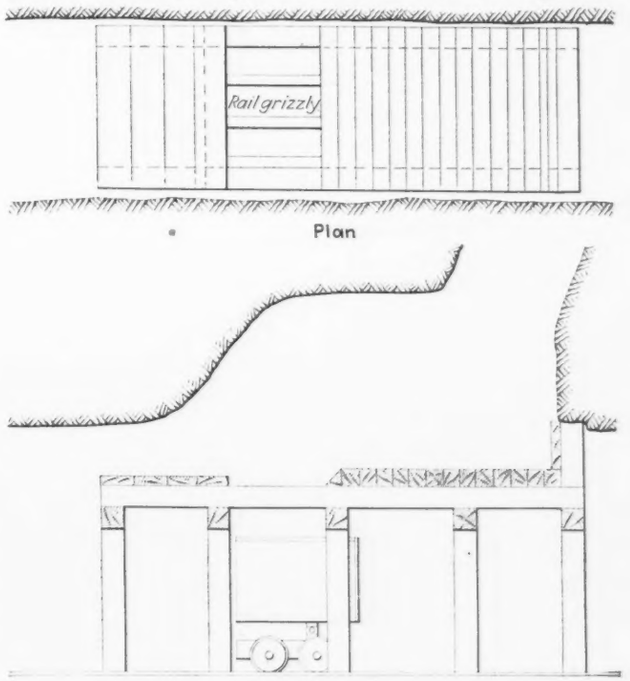


Fig. 2—Loading platform at each level

C, to allow for sufficient clearance below the cages in compartments A and C and the counterweight in D. A bulkhead was placed just above the level in Compartment E to allow free access by means of ladders to the work below. In Compartment B a bulkhead was

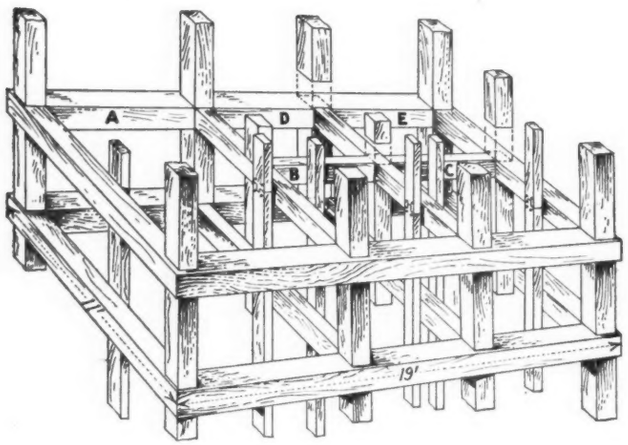


Fig. 3—Perspective sketch showing shaft timbers

placed 50 ft. above the 1,400 level and cage service in this compartment was stopped at the 1,300 level. Service in compartments A and C continued to the 1,400 level throughout the deepening process from the 1,400 to 1,800 level.

A small service hoist was installed at the 1,400-ft. station and service maintained in Compartment B, through which all timber and supplies were handled for the job. The shaft was timbered throughout with redwood. The wall plates, end plates, and posts are 12x12 in.; dividers are 10x12 in., and the 8x12-in. lagging is 2-in. redwood plank.

As each set was hung the broken rock was drawn down sufficiently for the placing of an additional set. In some places the walls had sloughed to an extent that bridging behind the sets was necessary. However, little trouble was experienced on account of over-break during the shrinkage operation, and because of the careful engineering supervision no extra rock had to be cut to make room for the timbers.

The operations incident to the deepening of this shaft may be divided into: (1) The driving of the pilot raises; (2) the shrinkage of the shaft to full size required for timbering; and finally, (3) the placing of the timber.

The following cost and efficiency data are submitted:

Sinking New Pilares Shaft from 1,400 to 1,800 Levels

	Amount	Cost per Foot
Summary		
Pilot raises	$2,681.47	$7.066
Widening and shrinkage	2,846.46	7.501
Timber and timbering	15,998.29	42.156
Miscellaneous	4,200.48	11.068
	$25,726.70	$67.791
Statistics		
Distance sunk, ft		379.5
Distance timbered, ft		382.5
Size of shaft excavations, ft		12 x 20
Over-all dimensions of timber, ft		11 x 19
Total labor cost		$9,111.65
Total shifts		2,568½
Shifts per foot of advance (*sinking only*)		6.76
Total labor cost excluding shop expense and timber framing		7,272.99
Total shift cost excluding shop and timber framing		1,954½
Shifts per foot of advance (*timbering and widening*)		5.15
Timber used, bd. ft.		248,909
Timber per foot of shaft timbered, bd. ft		650
Total powder used, lb.		3,778
Powder per foot of shaft, lb.		9.95

Pilot raises started March 8, 1924.
Shaft in operation Dec. 15, 1925.

Details and Distribution of Costs

	Amount	Cost per Foot
Pilot Raises		
Labor		
Breaking	$844.85	$2.449
Mucking	231.15	.670
Supplies	29.00	.084
Drills and tools	802.40	2.325
Explosives, 1,716 lb.	660.54	1.915
Timber, 2,640 bd. ft.	113.53	.329
Total	$2,681.47	$7.772
Feet of raising		345
Feet per shift—contractor breaking only		2.09
Pounds powder, per foot		4.973
Contract breaking shifts	165	
Contract mucking shifts	186	
Total shifts	351	
Feet per shift		0.983

	Shifts	Amount	Cost per Cubic Meter (35.3 Cu.Ft.)
Widening and Shrinking			
Labor			
Shaft	277½	$1,831.07	$0.774
Shop	10	30.35	.013
Drills and tools		553.03	.234
Explosives and handling		432.01	.183
Total		$2,846.46	$1.204
Tramming cost 15c. gold per ton-car not included in this cost			
Pounds of powder used	1.631 per cubic meter		$0.6899
Volume removed	83,502 cubic meters		2.364
Distance shrunk	379.5 ft.		

	Shifts	Amount	Cost per Ft.
Timbering			
Labor			
Framing	466½	$1,428.30	$3.734
Placing	861	3,160.94	8.264
Shop	38	249.10	.651
Total	....	$4,838.34	$12.649
Timber and supplies, 212,346 bd. ft.		11,119.95	29.072
Incline charges		40.00	.105
Total timbering cost		$15,998.29	$41.826

Labor represents 382.5 ft. of completed work.

Miscellaneous Expenses Incident to Completing Shaft

Labor	Shifts	Amount	Total
Sundry contracts	465	$1,204.98	
Shops	59¾	130.91	
	524¾		$1,335.89
Supplies			1,029.22
Drills and tools			111.49
Explosives and handling (431 lb.)			114.23
Timber, 33,923 bd.ft.			1,609.65
			$4,200.48

Including building bulkheads, safety devices, installing equipment, and incidental supplies and labor.

All amounts and costs are calculated in United States gold.

Manufacture of Xanthate

Most of the xanthate used by American flotation operators has been made by a company on the Pacific coast, though two or three companies in the East have also been sellers. At least one consumer is reported to have made his own supply, and some of the Southwestern mills are now getting their xanthate from an Arizona powder company that has recently begun producing the reagent. A method of manufacture recently patented in England (No. 252,500; 27.3.25), by the British Dyestuffs Corporation, is abstracted as follows in *British Chemical Abstracts:*

A solution of an alkali hydroxide is added slowly to a well agitated mixture containing theoretical amounts of alcohol (as methylated spirit, or, in the case of higher homologues, the constant-boiling mixture of the alcohol and water), and carbon disulphide in a reaction vessel provided with a reflux condenser. After a few hours any unchanged alcohol and carbon disulphide are recovered by distillation, and the crude alkali xanthate is dissolved in water and treated with sufficient dilute hydrochloric acid to neutralize any free alkali and to decompose any alkali thiocarbonate that may be present. To this solution is added, while stirring, the theoretical amount of a solution of a soluble salt of a metal which gives an insoluble xanthate, the latter being precipitated in a state of division such that, after washing, it is obtained in a high state of purity.

Some Essentials for Successful Oil Development

The Factors Which Must Be Considered Before Undertaking to Search for Petroleum in a Country in Which Little or No Prospecting Has Been Done

By Frederick G. Clapp

Consulting Geologist and Petroleum Engineer, 50 Church St., New York City

Frederick G. Clapp

WHAT is necessary in order to establish successful oil development in a country that is unprospected or little prospected? Most persons in other trades and professions have little conception of the complexity of the oil business and of the multifold difficulties that attend a search for oil and its development. This ignorance frequently causes a state of apathy, so that in countries where oil has not yet been commercially produced, little substantial encouragement is given corporations which are spending their money in prospecting. In this paper I shall endeavor to elucidate some of the existing misconceptions. The discussion is not considered as being more than an elementary one, but the explanations made may be of some value to the investing public and to the habitants of countries that contain undeveloped resources.

Certain expressions to be used in this article will be first defined. In inserting the word "successful" in the title I have in mind an axiom that oil and mining companies are organized for profit and that they must be given a fair business chance of becoming dividend payers; otherwise, their existence is unwarranted. Under "development" is included every phase of an oil-producing business, from the preliminary geologic studies through prospecting, acquisition of leases or drilling rights, sinking of test wells, actual discovery of oil, and its delivery to the market at a suitable price to assure the financial success of the company concerned. The "essentials" of oil development are intended to include such conditions of geology, land titles and laws, markets, economics, public opinion, personnel, *et cetera*, as may be vital to the success or failure of an industry. An axiom of oil development, as of every legitimate business venture, should be that it shall fill a need and render service in proportion to the profit assured and inversely to the risk taken.

A few essentials of successful oil development are the following:

1. Suitable fundamental geologic conditions.
2. Suitable secondary geologic conditions.
3. Suitable conditions for acquisition of a large area of leases for development.
4. Experienced advice.
5. Adequate capital.
6. Competent management.
7. Suitable laws and regulations.
8. Adequate and profitable markets, transportation facilities, and unrestricted trade conditions.
9. A helpful government and community.
10. Actuality of the oil.

Possibly in this enlightened age a few persons may remain of the opinion that the only necessary condition on which to base oil development is to find a favorable geologic "structure," to drill a well thereon, and allow the oil to flow; whereupon the fortunes of the promoters will be assured and the district brought from a condition of poverty to one of wealth. How far this is from the truth will be explained. Some persons will even declare that favorable geology is not essential, since, in their opinion, "oil exists where you find it." Such an idea is an alarming symptom, and the most reckless speculator would be foolish to trust his funds to a promoter of such caliber. As a matter of fact, the suitability of geologic conditions is one of the first essentials to a successful oil development.

When May Oil Be Predicted?

In this brief discussion I can barely touch on the subject of oil geology, which is an intricate branch of engineering. A fundamental assertion may be that an oil field cannot be safely predicted on the basis of one or two geologic factors alone, but many criteria must be given careful attention. Even after a consideration of existing conditions an oil field cannot be safely predicted simply because a majority of the questions or most of them have been answered satisfactorily; but every individual criterion should be answered affirmatively (or at least a negative answer must not prevail) if oil is to be wisely predicted. If every question can be answered favorably, test wells can then be safely drilled; if some of the questions be answered favorably and the answer to others be unknown, the business may still constitute a "good gamble" in the mind of an oil man; but as a rule, if all but two criteria are answered in the affirmative and those two be answered negatively, the prospects are unfavorable. In fact, I know of only one fundamental criterion (namely, presence or absence of oil seepages or "surface indications") that may be answered in the negative and a reasonable prospect remain of finding oil in commercial quantity. If signs of oil be found on the surface, on the contrary, every effort should be made to make sure whether they are genuine.

The principal fundamental criteria which should generally be applied in a search for an oil field in an untested region are the following:

1. Do surface indications exist?
2. Are the ages of strata similar to those prevailing in existing oil fields?
3. Does a possible source of origin exist? If this is not apparent, may it nevertheless be present?
4. Do porous beds exist in which oil may be held in commercial quantity?

5. If so, does sufficient "cover" exist over these beds to prevent oil from escaping to the surface and having been lost?

6. Are the strata so little metamorphosed (altered by heat or pressure) that the oil has presumably not been driven off in the past?

7. Does any local geologic structure exist suitable for concentrating oil in commercial quantity?

The seven questions enumerated are among the first asked by a geologist who is searching for oil in any untested district. Surface indications are not always necessary; many producing fields in the United States evince none (oil or gas seepages, bituminous dikes, saline springs, and similar evidence of the presence of oil). This may be because the strata are too thick, unbroken, or impervious, so that no escape of oil or accompanying fluid takes place.

The source of origin may sometimes not be provable, but the geologist should make sure that conditions do not prohibit the existence of a source, as would be the case if the surface consist entirely of non-extrusive igneous rocks or if the strata be exclusively quartz sandstone from the surface to the underlying igneous or metamorphic basement.

Negative Criteria Must Be Absent

With these exceptions, however, all conditions should be answered affirmatively if the district is to be considered favorable for oil. In other words, if the strata be of an age in which oil is elsewhere unknown, or if their character be such that no possible source of origin can exist, or if no porous reservoirs with overlying impervious "cover" rocks exist, or if the geologic "structure" be not suitable for the concentration of oil in quantity—if any of these defects exist, an oil field is not likely to underly the locality. Thus it is important that all fundamental criteria except the question of seepages be answered affirmatively or, at least, that the criteria be not answered in the negative. If the answer be negative, the field cannot, as a rule, be recommended for development.

Assuming, however, that a possible source of origin be known, that seepages exist, that ages of the strata are identical with those of certain known oil fields, that definite porous sandstones or limestones underlie the region, that they are covered with a thick clay capping, that suitable conditions of non-metamorphism have been found, and that satisfactory geologic structure exists, still a geologist may be obliged to report adversely, on account of any one of several factors which may be called "secondary criteria." That is, in addition to the fundamental criteria he may, in his reconnaissance or detailed studies, have discovered some of the following circumstances:

1. Faults or "breaks" may exist in the strata. These may or may not be unfavorable to oil occurrence.

2. The region may be subject to frequent or violent earthquakes. Some persons have supposed these to be unfavorable.

3. Favorable porous beds, though present, may lie at such great depth that the geologist must inquire whether they can be reached by drilling.

4. Although porous beds be present, they may form the surface, so that most of the oil may have leaked away in the past.

5. The beds may stand on end, in which case the structures may be so strong, so superficial, or so "open" as to raise a question whether they permit present retention of oil.

6. "Sands," though present, may be of insufficient porosity to hold oil in quantity or too fine grained and dense to yield oil readily by flowing or pumping.

7. If oil be present, gas may not accompany it; hence no natural means may exist to drive the oil into the wells from surrounding portions of a productive stratum.

8. Oil may be present but unsuitable for commercial use in the available markets.

9. A source of origin, though present, may not be so related to porous beds that oil can have collected in them (as, for instance, where petroliferous shales exist in a superficial formation but the porous beds lie thousands of feet beneath).

10. Volcanoes may abound in the vicinity, and the geologist must inquire whether they have favorably or adversely affected the presence of oil.

11. Geologic structures, though existing, may not embrace any of the well-known types in which oil is likely to occur in quantity. The structures must be carefully studied to ascertain their bearing on oil occurrence.

12. Where artesian waters under high pressure exist, they may in some cases have affected the situation adversely, but the presence of artesian waters is not always unfavorable.

13. Oil may have been removed in times past by human or natural agencies. If any reason exists to suspect such removal the facts should be ascertained and the doubts verified or eliminated.

This list of possibilities that may exist and need solution is not a complete one. The various factors are enumerated to show how careful a geologist must be; and even with most complete studies a possibility remains of the existence of some unknown, indecipherable, unfavorable condition which might prevent the occurrence or extraction of commercial oil.

Wide Extent of Territory Necessary

Even if the geology be favorable, the path to success is by no means clear, for the operators must have sufficient land on which to operate safely. To persons unfamiliar with the oil business it may seem strange that a corporation searching for oil in an untested region requires leases or development rights on many thousands of acres. Some corporations have been misnamed "monopolies" on account of their large holdings. Thus, I must explain that in general a few hundred acres are not sufficient to assure a reasonable hope of success, if a company is to supply the market profitably with commercial quantities of oil or its products. An oil industry is a "hazardous" business; investors in such a venture are entitled to an unusual percentage of dividends in the event of success, and their success can be hoped for only through large lease holdings.

Since the oil business is a hazardous one, it is suicidal for any company which is about to engage in prospecting to limit itself or to allow itself to be limited to a few hundred acres of land. In an untested country thousands or millions of acres are necessary to assure any hope of success, since much of the territory will undoubtedly be found barren and since constant prospecting over large areas is necessary to eliminate the unfavorable lands. A company must be allowed to acquire a very large area during its exploration, so that,

if oil be found, operations can be continued for many years. In a few instances where profit has been derived from operations on a few acres or a few hundred acres, the position of the field has generally been known in advance of drilling.

In the vast majority of oil districts, however, even in the United States and Mexico, the definite existence of oil was not previously known, and a large percentage of the wells drilled in trying to find it have been failures. Extensive oil rights are required so as to assure shareholders "a run for their money," and, if oil be found, to enable the company to embrace all contingencies of its existence and produce sufficient oil to pay for all prospecting, unproductive test wells, and allow a reasonable profit.

The government of Western Australia, for example, was wise in allotting exploration areas of hundreds of thousands of square miles to individuals or companies, because the chances of oil were there so unfavorable or so little known that no company could be expected to enter the state to explore or operate with any less inducement. But the wisdom of the Westralian policy ceased with the granting of a large oil prospecting area, for the holdings of an individual company were to be reduced by law, after the finding of oil, to an area of only a few hundred acres, which would oblige any company to resort to subterfuge, or "dummying," in order to retain a sufficient area for profitable development. If a company can find oil in such a geologically unfavorable country as Western Australia it should be entitled to the entire oil prospecting areas on which it holds exploration rights. No oil development is practicable in a country having laws which greatly reduce the holdings of a successful prospector after he finds oil by drilling.

Experienced Advice Necessary

An oil venture is found to be largely a gamble even with suitable geologic conditions. Hence, to avoid as much risk as possible, a company which intends to drill in an untested field should employ geologists who have had years of experience in examination and appraisal of prospective oil fields. The advice of novices, of persons who have not specialized in oil, or of "quacks" who locate by divining rods or devices without geophysical recognition, should not be followed. It is important to state here, however, that certain instruments, such as torsion balances, seismographs, variometers, and other scientifically constructed devices, have now taken their place as a valuable addition to technical equipment when in the hands of experienced geologists with geophysical assistance.

Where a large amount of money is at stake, as in deciding the first important question of whether a certain region or district should be tested, only the advice of the most experienced oil geologists should be followed. In later stages, after the fundamental and secondary geologic criteria have been found favorable by experienced specialists, the advice of younger men may often be followed as to the details of the fields. An army of young geologists is employed on details of the business, such as in making locations, deciding the type of drilling equipment to be used in a specific instance, where to shut off water, at what depth to bail the wells and test for oil, and the like. With so many geologists available who are experienced as to fundamental conditions or on details, as the case may be, there is no advantage in following suggestions made by novices.

Naturally, this brief discussion cannot enter the province of oil geology and explain the methods used in solving the various criteria enumerated. Such a treatise is found in several good textbooks, handbooks, and many volumes of technical papers prepared by members of the American Association of Petroleum Geologists, the Society of Economic Geologists, the Institution of Petroleum Technologists, the American Institute of Mining and Metallurgical Engineers, the Geological Society of America, and other professional societies. To these and other publications a student of oil geology is referred; but, in addition to carefully studying their contents, he should serve his years of apprenticeship on a geological survey in an oil-producing district, under the direction of an experienced oil geologist. However, I cannot recommend young men to a study of oil geology at the present time, when the profession is stocked with so many high-grade men.

Capital Must Be Adequate—Management Competent

In no kind of business is it so important to have adequate capital available as in the search for oil. Geologic investigations, establishment of a land department, securing of leases or drilling rights, employment of experienced oil-well drillers, purchase and importation of the most suitable drilling equipment, and actual drilling of test wells constitute an expensive start. If oil be not found in the first well, additional tests must be drilled, assuming that they are warranted by the showings obtained. If oil be found, then the field must be thoroughly drilled at consequent tremendous expense. Storage tanks and pipe lines must be constructed and arrangements made for refining the oil.

It is obvious that no individual or company should embark in the business without sufficient funds available in advance of drilling and a knowledge that additional backing can be secured in the event of striking oil. It is equally obvious that the development must be in charge of experienced oil operators, backed by wealthy financiers and under the advice of experienced technical men. With all its hazards, oil development is not properly a gambler's business, but must be properly conducted to offer reasonable hope of success.

Legal Essentials to Be Considered

Assuming now that all geologic questions have been satisfactorily answered, capable personnel has been secured, plenty of acreage is available, and that the capital and management are satisfactory, the road is not yet clear for a company to prospect for oil wisely. In some countries the rights to oil which exists under the surface are in part in the hands of freehold owners and in part owned by the government. The matter as to freehold lands is clear and generally satisfactory, for a company needs only to negotiate with the owner and acquire drilling rights from him on a suitable royalty basis, allowing him to continue farming, grazing, or other utilization of the land without interruption.

On government land the matter is not so clear. Some nations contain lands which are favorable geologically but which no sensible oil company will enter, for the reason that laws or regulations are such as to permit little hope of profit. Some countries which own their subsurface oil rights have offered from a thousand to hundreds of thousands of square miles to one individual

or company for oil prospecting; yet the law provides that if oil be developed therein the area that may be retained and operated is less than the identical number of acres. In such cases, no company can reasonably hope for profit on the oil-prospecting area, unless an oil field be already proven. Companies which have in the past made money on smaller acreages are exceptions to the rule, or the subsurface conditions and yield have previously been proven so definitely that the hazard of drilling may have been justified.

The policy of cutting down substantially a grant, permit, or concession after oil is discovered on it puts a penalty on the company which spends its money in making a discovery. The laws should not require the discoverer to surrender valuable rights after developing oil, but, instead, they should offer inducements for its discovery.

In the opinion of many students of the situation in oil fields the world over, a company operating on the public lands of any country should be given a long-term title to all land on a stated geologic structure or throughout a stated district after developing oil thereon, and should be free to continue prospecting on the remainder of the oil-prospecting area or permit. This was an ideal for which many leading geologists and companies worked in the United States when the public domain was opened to oil development in 1920. Considering the great risks involved, even the areas allowed on the public lands of the United States are too small for safe operations in an undeveloped field. Certainly no government situated outside of an oil-producing country, or in which the presence of oil is still problematical, can afford to take an even less liberal view of the requirements, as has been done by many foreign countries.

Obviously the attitude of the government and of the community in which operations are to be undertaken must be favorable to oil development, and a broad-minded "public opinion" is essential, wherein private and public landholders are willing to meet the company halfway, so that lands can be acquired on a basis that will be profitable to all concerned.

Action of Economic Laws Must Be Unrestricted

In the oil business, as with farming or manufacturing, the natural laws of supply and demand should be allowed to operate freely. As is the case in farming and manufacturing, so in oil development; no price can be set, markets insisted on or restricted, methods of drilling or location of plant insisted on in advance or by other persons than the operators, without danger of driving the industry away. So many parts of the world yield oil with profit that strong companies generally refuse to operate except under the most favorable conditions.

In the oil business, as perhaps in no other, laws of supply and demand maintain full play. When overproduction temporarily prevails, nothing but a lowering of prices will provide for the disposal of the excess output of oil products. Conversely, when a shortage prevails, only the companies that are directly concerned can fairly set prices at which the products can be purchased and sold by them. If a country be seemingly confronted by sufficient production to justify pipe lines, great storage tanks, refineries, and other expenditures, the men who are spending the money must of necessity determine to what extent they may safely increase expenditures from the standpoint of financial conditions and future outlook.

Never in the oil business have I known an economic question to be solved by legislation or governmental regulation. Thus, the economic essentials may be summarized by the statement that they must be kept free of legislation and regulation, enabling the operating companies to work out their salvation on the basis of supply, demand, and competition, which throughout the world's history have constituted the best price stabilizers and distributing factors of any product in the markets which deserve attention. Even in our own country, which has successfully regulated the so-called "trusts," the oil industry has not been interfered with to the extent of legislation affecting supply, markets, methods, or prices. The laws of supply and demand, as in all lines of business, have here been left free to shape the course of the industry, and this condition has made the United States a great commercial nation from the standpoint of oil as of other commodities.

I acknowledge the wisdom of a government in protecting its nationals against the imposition of unfair monopolies. I do not recommend that the oil business of any country be given over to a single company or that grants be made such as will stifle competition. Yet an oil-producing company must have an area adequate for development for many years to come, and must be permitted to fight its way in the universal economic struggle unhampered by laws or restrictions that might cause financial loss.

As an illustration, a refinery is a necessity at some stage in the affairs of any oil business if a large production be encountered, and a refinery will almost certainly be built sooner or later in any such country, for local refining is generally cheaper than to export and refine the crude oil. Yet no government is wise in forcing a company to build or in obligating it to guarantee a refinery at any stage of its operations. The oil will soonest be developed and placed in the domestic markets if operating companies be left unhampered and future steps be subject only to the discretion of the representatives of the investors themselves.

The matter may be made apparent by explaining that a single great gusher in a new field would constitute no indication that commercial oil has been found. Gushers generally decline rapidly, and it is frequently necessary to allow a well to flow into tanks or pipe line for months before even an idea of its "settled production" can be definitely obtained. It is unusual for a great gusher to hold its initial production for a long period; and a well "coming in" at (say) 1,000 bbl. daily is more likely to be flowing 100 bbl. daily at the end of the first year than to attain as much as 500 bbl. at that time.

The discovery well constitutes no indication as to the size of an oil field. One well tests only a single spot in the earth, and in some fields no wells besides the first one have been found. It is necessary to drill many wells for the purpose of outlining the field before an idea of its size and volume can be obtained; then the technical officers of the company may be competent to decide whether to build a refinery; but government officials cannot wisely do so. If a decision be made too early, the venture may fall. The incident of a company building a refinery at New Plymouth, New Zealand, many years ago, before sufficient oil had been developed, is sometimes mentioned to illustrate this truism. This refinery was later removed to Melbourne,

Australia. Though I have not investigated the authentic history of the New Plymouth refinery, the analogy seems a perfect one.

Markets and Transportation Must Be Considered

It is of course evident that suitable markets must exist somewhere within the radius over which oil can be profitably retailed. If an adequate market does not exist in the country of origin of the oil, an unrestricted right should exist to export it. If the oil be of refining grade, the company must be permitted to export it to a place where it can be refined until the company itself finds that economic conditions warrant the construction of a local refinery. If the business is to succeed, conditions of tariff, transportation and other factors must enable conveying the crude or refined oil to the particular markets at which it can be sold at a profit. If these conditions be not suitable, the business may fail, and the community of development as well as the shareholders will then be losers thereby.

Since a new oil development is a "hazardous business," it needs the encouragement of all persons, governments, and organizations who come in contact with it. In short, it needs active assistance if it is to take its place as an asset to any undeveloped community. Tacit friendship is not enough. If capital is to enter and be useful in a country's development, legislation must be suitable for encouraging the growth of the infant industry.

To encourage oil prospecting, a government may wisely relieve machinery and equipment from import or other duties, as is done by some nations. It is expected that a company entering any country to develop oil, thereby spending millions of dollars (as is generally imperative to assure success) will have its investment protected. A government should use every effort to encourage, protect the rights, and facilitate the financial success of any company endeavoring to develop the resources of the country in question, for thereupon depends the nation's future prosperity. The United States owes the greatness of its oil industry largely to broad national policies which in early days of the business refrained from limiting or hampering the entrance of domestic or foreign capital.

Charity Not Sought

In asking a state or a community for an encouraging attitude, a company does not seek charity, but it is willing to take the legitimate risk involved in oil prospecting. The company may reasonably ask, however, that if profits be made, they will not be taxed at a prohibitive rate or legislated into oblivion. In asking for the co-operation of farmers in a section where it is planning to operate, a company does not want to be given any land or to buy land. All it wants is to lease the drilling rights for a sufficient number of years on a small royalty basis; then, if the property be found unproductive after drilling, the rights are surrendered. If the land be productive of oil, the owner will share in the profit and his royalty profit will probably equal or exceed the net profit of the company, handicapped as it is by the expense of drilling the productive wells and failures.

How Big Is the Oil Supply?

Some persons who are not entirely familiar with the methods of geological occurrence of petroleum declare that the supply of oil is ample for hundreds of years. Nothing could be further from the truth. Notwithstanding temporary periods of overproduction, studies by government and private geologists have shown that oil fields of the United States may be approximately 50 per cent exhausted, that few fields of great size remain to be discovered in this country, and that consumption of oil is mounting rapidly year by year, so that it is anticipated the production of oil in the United States will largely cease within a few decades. When that time comes, Venezuela, Russia, Persia or other countries may take the place of the United States in supplying oil needed for the industries of the world. As the output of the fields of Pennsylvania ascended and declined, so it will be with those of all productive nations, and the production of Venezuela, Russia, Persia and the rest will eventually decline.

"SOME declare that the supply of oil is ample for hundreds of years. Nothing could be further from the truth," says Mr. Clapp. "Notwithstanding temporary periods of overproduction, studies by government and private geologists have shown that the oil fields of the United States may be approximately 50 per cent exhausted; that few fields of great size remain to be discovered in this country, and that consumption of oil is mounting rapidly year by year. It is anticipated that the production of oil here will largely cease within a few decades. When that time comes, Venezuela, Russia, Persia, or other countries may take the place of the United States in supplying oil needed for the industries of the world. As the output of the fields of Pennsylvania ascended and declined, so will that of all of the present productive nations."

Petroleum supplies have been cataloged by students of the problem, and it has been found that a few decades will have removed the greater part of the economically extractible oil from the earth, after which some other fuel or source of power must be discovered or oil produced synthetically. The officials of large oil companies are not misguided fools; they have a definite plan of campaign, and the fields (despite the vast discrepancies in figures of over- and under-production) are, where the operators are unhampered, developed according to system. The large companies wish to stabilize production and selling prices throughout the world, and are to some extent succeeding. Any meddling by governments only makes this problem more difficult and results in greater variation of prices from month to month and year to year, according as world production is at the particular time over or under the existing and predicted consumption.

No Drilling Unless Reasonable Chance of Success

I am divulging no secret when I state that experienced corporations would not drill for oil in any country unless a reasonable chance of success existed. Oil operators in any country have usually been advised in advance of drilling that technical conditions are sufficiently favorable to justify the speculation. Presumably their geologists have told them that potentially favorable

conditions exist. Nevertheless, no geologist can look into the ground and see whether oil actually lies there. The most that can be done is to make predictions on the basis of existing conditions, some of which have been enumerated in this paper. The drilling of any well may result in financial disaster, for failures sometimes occur even in great oil fields. In fact, in the vicinity of oil fields the percentage of failures is generally large, for a large number of wells is generally drilled thereabouts. The risk of not finding oil in commercial quantities constitutes a real danger in any country that is being prospected.

Even if oil be present, it may remain undeveloped owing to difficulties in drilling, of which there are too many to mention here. An additional danger is that a well-meaning but misguided government may initiate policies, laws, or regulations which will seriously interfere with the development of oil in quantity, will insist on transportation, refining, or marketing conditions prohibitive to success, will overtax the product, or by some other means will cause the failure of the enterprise. The partial withdrawal of oil companies from Mexico was not due entirely to failure of the fields (although most great pools did turn into salt water producers), but the Mexican Government had so hampered the oil industry by legislation and other interference that business could not be conducted with profit. Certain parts of New Guinea remain undeveloped, not entirely because it is not a "white man's country" but to a considerable extent because the laws do not permit the permanent acquisition of sufficient acreage on which to operate with any expectation of profit.

In the early days of oil development in any country it is habitual for the inhabitants to be fearful of results, perhaps supposing that oil may injure their land, that the owners may be hampered if they desire to sell, or that some calamity which they are unable to define may befall them. As the development becomes an actuality, farmers and others generally reverse their attitude, finding their interests helped rather than hindered by the new industry. Trade and employment conditions become better, lands increase in value, and their sale becomes easier. As fast as individuals begin to receive regular royalties on oil, they find themselves miniature oil magnates; thus fears vanish, and the closing stages of the business witness a complete harmony between owners, operators, and consumers, which is a desirable consummation to be achieved in any community.

Such being the case, it is wise for any community to advance every encouragement—personal, commercial, and legislative—that may help to assure the early success of the companies operating there. Thus the difficulties that must be surmounted by the oil industry may be minimized and a new prosperity arise, provided that oil be present in commercial quantities and that the other essentials for successful development remain unhampered.

Prospecting for Copper by Airplane

Variation in Color and Type of Vegetation Main Guide—Rock Outcrops Readily Recognized—Promising Areas Subject to Further Study

By George L. Walker
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AIRPLANES are to be employed in Africa to prospect for copper ore over a vast area. A contract has been signed under the terms of which the Aircraft Operating Co., Ltd., is to send two planes to Africa immediately. The arrangement is restricted at present to approximately 52,000 sq.mi. embraced in the concession of the Rhodesian Congo Border Co., but it probably will be extended to the other companies holding special prospecting concessions in Northern Rhodesia. The position of their concessions in relation to the Katanga copper belt is shown by the accompanying map. Their issued and authorized capital and the extent of their concessions follow:

	Issued Shares	Par	Authorized Capital	Area, Square Miles
Rhodesian Congo Border..	300,000	£1	£500,000	52,000
Rhodesia Minerals.....	164,833	£1	£200,000	12,500
Loangwa Concessions.....	715,000	5s.	£200,000	13,000
Serenje Concessions.....	150,000	£1	£225,000	46,000
Kasempa Concessions.....	150,000	£1	£225,000	25,000

This plan should not be considered in the light of a mere experiment. Officials of Minerals Separation, Ltd., and Rhodesian Congo Border (the former acting as general managers of the latter), have examined and studied from every angle the results of airplane reconnaissance work conducted in several countries. This, together with the information obtained by a large amount of successful prospecting already done, has made clear the feasibility of this method of discovering ore deposits. The work will be done on thoroughly scientific lines, a specially organized force of experts carrying out a carefully prepared plan.

Reason for Using Airplanes

There are well defined reasons for the adoption of airplanes as prospecting agents. It was demonstrated in the Burma forest survey that different kinds of trees could be distinguished readily from a height of 8,000 ft. The Canadian Geographical Survey work disclosed that from an airplane the most minute variations in surface conditions could be detected and photographed over areas six to ten miles in extent. In England the dwelling places of ancient peoples, indistinguishable on the ground, often can be detected from an airplane by wide outlines of grasses, wheat and other growing crops of a slightly different shade of color.

That which is to be looked for in Africa is of far higher visibility than any of the things mentioned. It will be recalled that in the several published descriptions of the Katanga copper belt emphasis invariably has been put upon the fact that while the country is wooded, all of the many great outcrops of copper ore are almost wholly bare of vegetation. This is due to the salts of copper killing practically everything that grows

Northern Rhodesia and principal copper concessions

in ordinary soil. Precisely the same rule applies to the outcrops of copper carbonate ore in the region adjoining the Katanga on the south, which is being prospected by Rhodesian Congo Border Concession, Ltd., the geological formation and other conditions being almost identical.

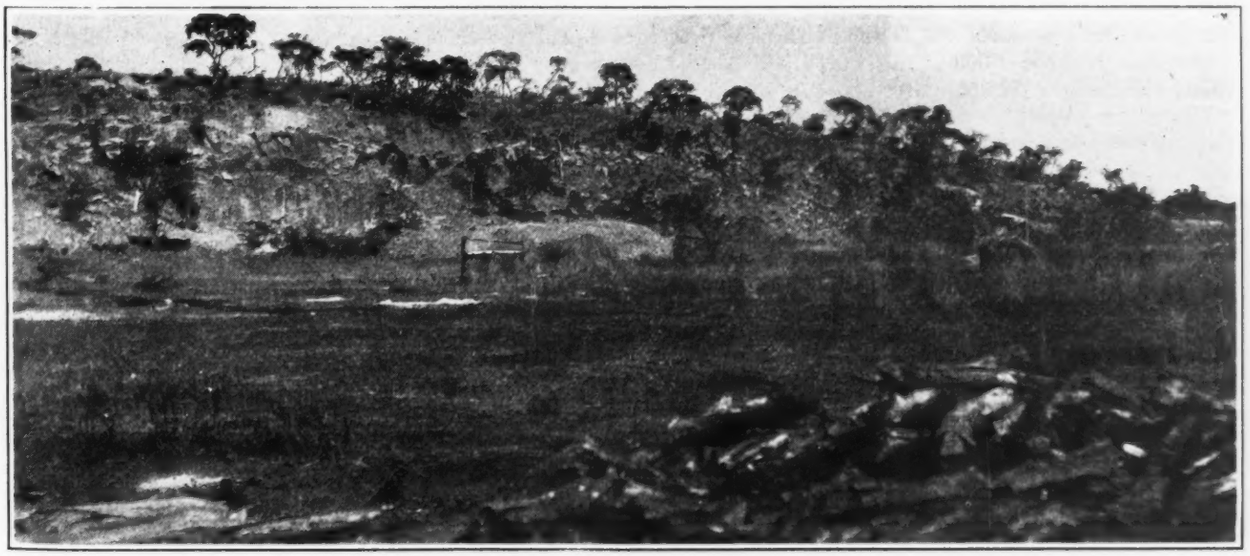
Prospecting and development work and other experience of Rhodesian Congo Border's engineers in the field have shown that the deposits of copper carbonates are interbedded with stratified rock formations, occurring much as beds of coal do. Erosion appears to have worn away most of the anticlines, leaving the largest deposits of ore occupying synclinal folds. In consequence the outcrops usually extend in a wide curve, and such semicircular croppings are characterized by a pronounced absence of vegetation. But as there are many openings in the wooded areas of Northern Rhodesia, those that are due to the action of copper salts often are not readily discerned by the man on foot. Prospectors have been known to cross and recross such belts of barrenness repeatedly without suspecting the presence of copper minerals a few feet below the surface, the far-flung curve of the opening being invisible to them.

The shape and extent of the openings in the forest distinguish from all others those due to the presence of copper ore, but the only point from which the outlines may be observed is above. Cases can be cited where there are two, three or more ore croppings in the same general locality that until recently were supposed to be as many different deposits; but familiarity with the district has brought to light a curved opening through the woods, from fifty to several hundred feet wide, connecting the croppings and proving them to be a single large deposit. Several deposits, of which the foregoing is in a general way a description, already have been located.

Airplane Prospecting 1,300 Times Quicker

Airplane prospecting will be more effective and also a tremendous saver of time. It is possible, of course, that some of the smaller ore deposits may be overlooked, but it is not the small ones that are being hunted for. The object is to locate and peg all the large and probably valuable deposits of copper ore in the area before the special prospecting concessions expire. The concession companies have about three years left in which to complete the work (which period may be extended). It has been found that an engineer and a practical prospector, assisted by a few natives, can prospect about 200 sq.mi. in a year. At this rate it would take five such prospecting units 130 years to complete the work, and it manifestly is impossible to build an organization large enough to prospect the entire region in as short a time as three or three and a half years.

It is estimated that an airplane can cover the entire 130,000 sq.mi. systematically and thoroughly, locating all of the principal copper carbonate ore deposits, in about 160 days. As it would take about 650 years to prospect this region with a single prospecting unit on foot, it appears that airplane prospecting will be some-



Ore outcrop at Bwana M'Kubwa mine

The trees shown are growing in rows along the ridges of sedimentary rock which stand up between the lodes or ore. The barrenness in the foreground has resulted from copper salts from the outcrop being mixed with the soil.

Outcrop at Bwana M'Kubwa mine, Northern Rhodesia

The pit is one of the ancient workings in ore. Immediately above on the hill, trees are seen growing on an interbedded stratum of sedimentary rock. In the background the open bush forest which covers the country is visible.

thing like 1,300 times quicker. The peculiar conditions which have been described are expected to lead to the discovery of ore deposits that men on foot would be likely to overlook.

Plan for Procedure

The first flying will be over the N'Changa and other areas the geological and ore-bearing conditions of which already are well known. Each of these will form the center of perhaps 1,000 sq.mi. which will be photographed carefully. The photographs, overlapped so as to form a complete panorama, will be studied by the geologists to ascertain whether they convey further information concerning these areas. These photographs also will be retained for comparison with those to be taken later of wholly unknown areas.

Following this preliminary work, flights will be made along parallel lines until a complete photographic picture of the whole concession has been perfected. Wherever interesting conditions are revealed that particular spot will be revisited and photographed again, both obliquely and vertically. The company's geologist also will fly over the area, studying it from the air.

Several emergency landing fields having been prepared, it will be possible to carry men and supplies to near-by points, from which the men will proceed to the areas thought to be mineralized and peg them. The work of trenching and drilling such areas will follow.

It will be appreciated that a complete photographic map of the area will be an immense time and expense saver in laying out roads, selecting mill sites and in many other ways. Centers of native population will be revealed; also water powers and the most available timber. There is no intention to relax the other form of prospecting. This work, already highly productive of results, is being continued vigorously.

After Big Prizes

The great value of the big deposits of carbonate ore for which the search is being made warrants the expenditure of exceptional effort. It is quite probable that 100,000,000 to 150,000,000 tons of 3½ per cent ore will be developed in the N'Changa-Dambo deposit. Other outcroppings in the near vicinity suggest the possibility of largely increasing this indicated tonnage. The Mimbula district, 10 miles south, has been declared to be likely to develop an enormous tonnage of low-grade ore, with higher grade at depth. It apparently comprises 4 sq.mi. of ore. Although no official details of the Chifumpa developments have been given out, it has been stated that ore comparable in richness to that of Katanga is being opened up over good widths.

Comparison will bring out the importance of these developments. In the 76,892,943 tons of proven ore reported by Union Minière du Haut-Katanga there are 5,285,640 tons of metallic copper. If the work at N'Changa develops, as is now indicated, 150,000,000 tons of 3½ per cent ore, the tonnage of contained metal will be approximately the same as that in the Katanga reserves. This does not take into consideration the ore being developed in the Mimbula, the Chifumpa, or in the company's porphyry district. The recent activities of the management indicate that deposits of copper carbonate ore are regarded as of even more importance now than they have been heretofore.

Loss of Copper and Nickel in Converting

In a study of the copper and nickel lost in slagging iron from matte, B. Bogitch (*Compt. rend.*, 1926, vol. 182, pp. 1,473-1,475) reports the following observations, as abstracted in *British Chemical Abstracts:*

Since the heat of formation of ferrous oxide is greater than that of cuprous oxide, it is usually thought that the loss of copper or nickel from the mattes during removal of iron is due to mechanical entanglement in the slag. To test this, samples of copper and nickel mattes were powdered, mixed with sand and sodium sulphate, and then fused, the sodium sulphate acting as oxidizer. The resulting slag was then analyzed for entangled globules of matte, and for copper or nickel present as oxide in the slag.

Both copper and nickel are oxidized, and in increasing proportions as the removal of iron becomes more complete. For the greater part of the process the loss of nickel is less than that of copper, in spite of the fact that nickel oxide has a higher heat of formation than copper oxide; this is because of the difference in the heats of decomposition of cuprous and nickel sulphides, as a result of which the molten nickel decomposes sulphur dioxide, whereas copper does not. On the other hand, the removal of the last traces of iron is more difficult from nickel than from copper mattes. The more acid (and hence more viscous) the slag, the greater is the loss by mechanical entanglement, but this does not affect the relative amounts lost by oxidation. In practice not more than 4 to 5 per cent of the copper should be lost in this way.

Discussion

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Sees No Oil Famine

Increased Recoveries From Wells, Improved Methods of Refining, Development of Foreign Fields and Oil-Shale Deposits, and More Efficient Engines Assure Future Supplies

THE EDITOR:

Sir—A recent sensational article in *The New York Times* by J. A. Phelan stated that *"we are fast approaching an oil famine."* Oil producers have heard similar predictions for over a generation, and the facts show that Mr. Phelan's pessimism is unwarranted—that a panic is not "just around the corner." Washington conservationists have also frequently warned of an impending shortage for several years, although production and stocks steadily increase.

In 1900 the oil industry was threatened with a famine, as the discovery of gusher pools had ceased, the old wells were declining, stocks in storage were being depleted, and consumption was rapidly increasing. But in 1901 Captain Lucas discovered the Beaumont gusher pool that flooded the market, with 10,000- to 75,000-bbl. wells. This opened a new era, as the oil came from salt domes, whereas previously the production was from regular sandstones that averaged 100-bbl. wells, with occasional 500 to 5,000 gushers. Other salt domes were rapidly developed in the Gulf Coastal area, and excessive capital was required to store the increasing flood of oil. Since 1901 it has been a serious matter to finance the increasing storage, which on July 1 amounted to 412,000,000 bbl. and represents $900,000,000 idle capital. Besides the annual interest loss of $54,000,000 on this enormous quantity of crude oil, there are further losses by evaporation, deterioration, insurance, and other charges, that increase the heavy burden of absorbing the excess oil when gusher pools overload the market.

After the salt-dome flood declined, in 1905, the Western states developed into large producers, beginning with Illinois in 1906. Then came Oklahoma, Kansas, northern Louisiana, Arkansas, North and West Texas, and Wyoming, and recently Colorado, New Mexico, and Utah promise to become important producers. The California output was small until 1901, but since then it has increased so rapidly that today it is the largest producer, with Texas and Oklahoma closely following. The daily output of the old seven producing states east of the Mississippi is about 110,000 bbl. and 95 per cent of present output is from the younger Western and Southern producers. The high prices during the World War stimulated unprecedented prospecting, which still continues, with the result of finding four to eight gusher pools a year, where formerly a new gusher pool annually was rare. A very important reason for the recent big increase in production is due to the employment of geologists for locating new fields. They were ignored by most oil men ten years ago.

The astounding increase in output since 1900 is shown by the following yearly productions:

	Barrels
1900	63,621,000
1910	209,557,000
1920	442,929,000
1925	760,000,000

The daily output on Sept. 18 was 2,220,711 bbl., which is about 100,000 larger than a year ago and it has been increasing at the rate of 5,000 to 40,000 bbl. every week for the last seven months.

Production today is probably at or near its zenith, and unless large gusher pools continue to be found, it will decline. This might warrant Mr. Phelan's pessimistic thought that "a panic is just around the corner" if the industry were to operate as it has in the past. But three very important factors will delay our future dependence on foreign oils, to wit:

1. The cracking process at the refinery.
2. Improved oil recovery from old wells.
3. Oil shale.

1. Cracking petroleum is an art that has been known for many years, but only within the last five years has it been developed on a large scale. From 30 to 60 per cent of gasoline is now obtained from crude oil through cracking that formerly yielded 15 to 25 per cent by the old straight-run system, and an up-to-date refinery now buys only half as much crude oil as formerly to secure the same amount of gasoline. Were it not for cracking, gasoline would today be double its present prices. Most of the large refineries have adopted cracking, but it is not yet used in many small plants, and at least 50 per cent more gasoline can be made when better prices justify adding expensive cracking equipment. About half the output of the average refinery is gas and fuel oil that approximates 350,000,000 bbl. annually, most of which is thrown on the market in competition with coal. The oil industry has been severely criticized for "wasting" such valuable material, which, through cracking, would yield 50 to 80 per cent of gasoline, and which sells at the refinery for 2c. to 4c. a gallon. But the gasoline market has been glutted for years and the refiners have to sell the low-grade products at prices that compete with coal.

2. In the old system of pumping, it is estimated that 75 to 85 per cent of the oil contents remain in the sand when a field is exhausted. Hence there is probably five times as much oil in the known oil fields as the 8,000,000,000 bbl. which has been produced to date. To recover more or less of the 40,000,000,000 bbl. that remain in the present oil fields, three promising meth-

ods are being tried: *(A)* Flooding, *(B)* by restoring pressure by air or gas, and *(C)* by mining.

A. In the Bradford district, Pennsylvania, the output of the old wells has been doubled and tripled by introducing water pressure behind the oil to force it to the wells. Though flooding is not a success in all fields, depending on local sand conditions, it promises greatly to increase the output from many of the old pools.

B. In Oklahoma compressed air and gas is being used, instead of water, to create artificially a pressure to force the oil to the well. This recent and more promising method permits of general use, with less risk than water flooding, although more expensive.

C. Mining will eventually be adopted in shallow, exhausted fields when the price of crude oil justifies the greater expense that this method entails, and it should recover 30 to 60 per cent of the abandoned oil.

3. Oil shale will become a very important source of petroleum when the price of crude oil advances sufficiently. The cost of producing oil from gusher wells ranges from 10c. to 25c., and from 50c. to $2.50 per barrel from pumping wells. Crude oil has ranged from $1 to $3.50 per barrel, depending on the grade and location, during the last three years, and shale oil cannot compete with well-produced oil at these prices. Although the industry is in an experimental stage in this country, it has been a commercial success for many years in Scotland. There are enormous deposits of shale in the Rocky Mountains that yield 15 to 40 gal. of oil per ton, and when they can be worked profitably they will be able to supply the local markets indefinitely. Large deposits also occur in the Eastern coal states, but the shales are low-grade, as they yield only 10 to 20 gal.

The handicaps of the shale-oil industry are, first, that it requires mining to secure the shale, then distillation furnaces or retorts are necessary to produce the oil, and the loss and expense in refining is greater than with pumped petroleum. But these extra costs can be met when crude oil returns to 1920 prices, when it sold for $2.50 to $6.50 per barrel. The shale-oil industry will be a low-grade manufacturing operation with $1,000,000 to $10,000,000 plants, and at what figure they can compete with well oil remains to be demonstrated. Estimates indicate that the shales of Colorado, Utah, Wyoming, and Nevada contain 75,000,000,000 bbl. of recoverable oil, which is nine times the total oil produced to date in this country.

Gas Engines More Efficient

Other important factors are also going to delay the eventual exhaustion of our oils. The consumption of gasoline by our 20,000,000 automobiles ranges from about 8 to 25 miles to the gallon. In Europe, where gasoline is 30 to 150 per cent more expensive, they secure 15 to 35 miles by using lighter cars, smaller engines, and higher compression. Before we had good roads, our automobiles had to be heavy and strong, with ample engine power. But with the increasing number of hard roads, lighter cars and smaller engines will be more popular, and a car brought out this year is said to make 30 miles to the gallon. By the use of high compression agents, cars can be made to average 25 or more miles, so it is probable that in five years the present yearly average of 500 gal. per car will be reduced to 300, if not to 250, and thus greatly conserve our oil resources.

Mr. Phelan states that the importation of foreign oils demonstrates that we are unable to supply our requirements, yet stocks have increased during the many years in which we have used foreign oil, and our domestic production has always exceeded our domestic consumption. Most of the large refineries are situated on the Atlantic Coast, where it is cheaper to use foreign oil than to ship it from the Western fields. There are many foreign oil fields, although only Russia and Mexico compare with our enormous output, which averages about 70 per cent of the world's production. Russia possesses extensive undeveloped fields, and at one time it produced more oil than we did. Mexico has developed to the world's second producer, and when that country secures a stable government, its extensive undeveloped areas may greatly expand its present output. Venezuela and Colombia promise to become important producers when higher prices justify the heavy outlays for pipe lines and dock facilities that are lacking at present, and other South American countries may become important contributors.

Much Undeveloped Territory

What the world can produce outside of this country is unknown, but as it is estimated that we possess only 15 per cent of the possible oil-bearing territory, foreign oil is destined to become important when our output suffers a serious decline. Even this country is not completely developed, after sixty years of intensive drilling, and most foreign countries have scarcely been scratched.

Oil is found in almost all the geologic formations, from the youngest to almost the oldest, so enormous virgin areas in foreign lands suggest that gasoline shortage will be unknown by those now living.

Mr. Phelan is probably correct in stating that cheap gasoline will soon be a thing of the past. The increasing depth of our recent wells, with their much greater cost, the steady shrinkage in the old producers and the 15 to 20 per cent yearly increase in gasoline consumption bespeak higher prices in the future. Today gasoline is selling for scarcely more than pre-war prices, and it is one of the few commodities that has not been advanced 50 to 150 per cent; this is on account of intensive competitive drilling that has resulted in overproduction; but the industry is advancing to a stabilized condition through consolidation.

Mr. Phelan is not alone in singing the oil requiem, for Mr. J. Koster, a director in several foreign oil companies, predicted in 1922 an oil shortage in two years, when we were producing 1,500,000 bbl. a day and there were 270,000,000 in storage. Today—four years later—we are producing about 2,200,000 bbl. and there is more than 400,000,000 in storage. However, the time is not distant—if not already here—when we shall face a decline in our output and a steady shrinkage in storage reserves. But it will not cause a panic or a cataclysm, as improved recovery methods will secure larger yields from our old fields, much larger yields of gasoline can be secured by cracking, and the shale-oil industry will begin to turn out increasing quantities when higher prices insure profitable operation. Oil imports will increase, and eventually we may largely depend on foreign oil, unless shale oil can be produced more cheaply than now seems probable.

St. Louis, Mo. H. A. Wheeler.

News of the Week

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Summary

PHELPS DODGE options Bonney mine, near Lordsburg, N. M.—American copper dependent upon European consumption—U. V. X. takes over Murray property at Rouyn, Quebec—Drop in silver prices felt at Canadian mines—Kirkland Lake Gold started mill Oct. 1.

Quapaw Indians file suit for ore proceeds—Tailing mills in Joplin-Miami district producing 400 tons of concentrate per week.

Dredge in Kittitas County, Wash., producing $10,000 per week—British Columbia mines declare dividends—Allenby may increase mill capacity.

Zinc prices stimulate activity in Joplin-Miami district—Polish zinc production less in 1925.

Bureau of Mines in co-operation with mine operators developing operating economies — Potash exploration meets obstacles—Shale-oil production begun.

Zinc smelter proposed to utilize power from Saguenay River, Quebec—Arvida, Quebec, producing 50,000,000 lb. aluminum per year.

Mexico establishes ten mining districts for administrative purposes—U. S. Vanadium sells plant at Rifle, Colo., to Union Carbide.

Barberton district, South Africa, has eleven producing mines—Tin an important factor in London market.

Crystal Copper leases Goldsmith mine to W. A. Clark, 3d.

Forty-three Miners Rescued After Five Days' Imprisonment in Pabst Mine

The main shaft of the Pabst mine, owned by the Oliver Iron Mining Co., Ironwood, Mich., gave way by caving of the walls on Sept. 24. Three men were riding on the cage at the time of the cave-in. They were killed, and found at the bottom of the shaft.

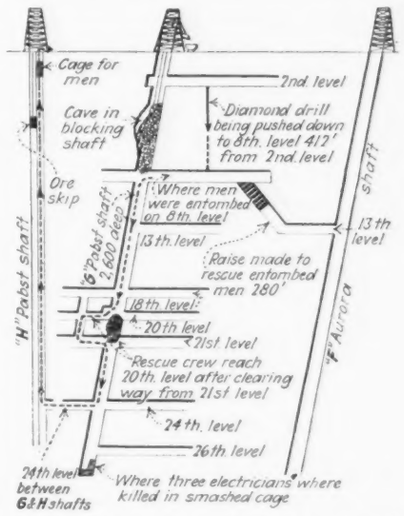
Forty miners were imprisoned on the eighth level because of the blocking of the shaft between the second and the eighth levels and another blocking lower down, between the twentieth and the twenty-first levels. One man was on the thirteenth and two men were on the eighteenth, and these joined their companions soon after the accident.

The rescue work was started almost immediately, in four different ways. First—One crew started to clear the shaft below the second level, but progress was slow because of the twisted steel and the rock and because of the nature of the work. Second—A diamond drill rig was set up on the second level to bore a 2½-in. hole down to the eighth level, a distance of 412 ft. The drill made good headway and it was thought food could be lowered to the men through the opening and communication be established. Third—A crew reached the bottom of the "G" shaft through the Pabst "H" shaft and started to work its way upward. Fourth—A short tunnel was driven and a raise started from the thirteenth level of the Aurora "F" shaft to reach the eighth level where the men were known to be. This raise had to go through 280 ft. and was believed to be the best chance of reaching the men alive. It was driven up at the rate of three feet per hour the first twenty-four hours and on the second day the progress was only twenty feet, due to running into a rock dyke.

The party working from the bottom of the shaft was the successful one. They traveled the shaft from the twenty-fourth level to the twenty-first, where they found the shaft blocked. They went back to an old raise from the twenty-first level and after 16 hours of work reached the twentieth level. After the rescuers reached the twentieth level of "G" shaft they were able to climb the entire distance of 1,200 ft. more to reach the 43 miners. The four men who were the first to reach the men were George Hawes, safety engineer for the Pullman Co., Chicago, who was for several years safety man for the Oliver Iron Mining Co.; Oscar Olson, chief mining engineer for the company on the Gogebic range; G. A. Erickson, mining captain at the Pabst "G" shaft, and Captain Harry Byrne, mining captain at the Tilden mine. The rescue party reached the men at noon Wednesday, Sept. 29. At 11:30 p.m. all of the men had been removed from the mine and were in one of the hospitals for a day's rest. There was an ample supply of good drinking water on the level and birch bark was used for making a sort of tea. There was oil at hand, so it was possible to make a light. None of the miners has shown any ill effects from the experience.

Too much credit cannot be given to Thomas Trewartha, who has been employed at the Pabst mine for 39 years and is now shift boss, who kept alive the spirit of the entombed miners.

One man tried to commit suicide by


Cage for men
2nd level
Cave in blocking shaft
Diamond drill being pushed down to 8th. level 412' from 2nd level
Ore skip
Where men were entombed on 8th. level
"G" Pabst shaft 2,600 deep
13th. level
13th level
Raise made to rescue entombed men 280'
"H" Pabst shaft
18th. level
20th level
21st level
"F" Aurora shaft
Rescue crew reach 20th. level after clearing way from 21st level
24th. level
26th level
24th level between G & H shafts
Where three electricians were killed in smashed cage

Sketch showing location of men and route of rescue

NOTE—The above sketch shows the approximate route taken by the forty-three entombed miners after the rescue party had reached them in their living tomb on the eighth level. For 1,200 ft. to the twentieth level they came down the patched-up ladders along the sides of the main shaft of the G. Pabst mine. Then they got around the obstructions in the shaft through raises between the twentieth and twenty-first levels and so on down to the twenty-fourth level, a distance of 470 ft. to the twenty-fourth level, connecting with the H. Pabst shaft. From there the journey up of approximately 2,400 ft. was made in the regular hoisting cages to the surface.

blasting with dynamite. The suicide was prevented by fellow prisoners. No mental disorders due to despair or any other cause were noticeable in the men, nurses said. The men were in good condition physically, except that some were still weak and exhausted.

They pooled their lunches, which had been partially eaten before the cave-in of the shaft Friday noon, and Trewartha rationed out the food in small bits, a square inch of bread or cake at a time. But it lasted only a little more than a day and then birch bark became the only food. They had subsisted on bark tea, made from strips of bark torn from the mine timbering and brewed slowly over their lamp flames. The concoction, bitter and almost revolting, kept them alive and, indeed, was considered palatable after several days.

When the rescuers arrived Trewartha held a counsel of rescue with Olson, Hawes, Erickson and his men and decided that the trip to the surface would require at least an hour's work by men with full stomachs and serene minds. It was decided that no one of the imprisoned men could negotiate the path safely in his weakened and hysterical condition, and it was finally agreed that food, hot and solid, should be brought to the miners before any one of them began the climb to fresh air and their families.

All of the men were given a preliminary examination by a physician who visited them in their subterranean abode. They declared they were all right, but officials thought it best that all go to the hospital.

None of the entombed men gave up hope. They took care to keep their watches running and knew that they had been imprisoned five days. Each twenty-four hours a mark was placed on a piece of timbering, indicating that another day had passed.

During the imprisonment the men made their way up the shaft for a short distance, and were able to go down to the twentieth level, but in each direction they were completely shut in. They could hear the rescue parties at work and realized they would be rescued.

There was great rejoicing in Ironwood when it was learned that the 43 were alive and would soon be to surface. Bands were out and there was little work anywhere. On Sunday Oct. 3 thanksgiving services were held in all of the churches in the town.

All of the mining companies operating on the range rendered assistance with men and equipment. Mine superintendents and mine captains from other mines worked as shift bosses underground. Oliver officials from Duluth were at the scene of the disaster at all times. Daily conferences were held, with mine managers from other companies called in to give advice. Everything was very systematic and the work was pushed to the limit without stop, employing about 500 men.

The mine rescue car "Holmes," of the U. S. Bureau of Mines was sent from Ishpeming to Ironwood, and rendered such aid as it could.

It is not known definitely what caused the hanging wall to break away. One theory is that the heavy rains of the month caused sand to be washed away, giving the rock a chance to exert extra pressure against the shaft walls. The other opinion is that the cage left the runners and tore away some of the wall plates, thus letting the rock into the shaft. Some time will be required to clear the débris and repair the shaft before hoisting can be resumed.

The mine is operated by the Oliver Iron Mining Co., at Ironwood, on the Gogebic, Mich., iron ore range. It has been working for about 40 years and has been a heavy producer. The "G" shaft is a 67-deg. incline on the footwall and is bottomed at 2600 ft. Some years ago the old timbers were removed and steel sets and concrete slabs replaced the old lining.

American Copper Dependent Upon Europe

STEPHEN BIRCH, president of the Kennecott corporation, recently made the following statement: "America's copper industry cannot really prosper with European consumption so far below normal. The copper industry has suffered as no other from effects of the war, and has never recovered from its consequences. The progress of Europe has been retarded, and with it the progress of the copper industry. The greatly lowered European consumption has been the cause of the unprecedented depression in our copper industry since the war. As Europe is restored financially and economically, America's copper industry should once more thrive and prosper."

U. V. X. Enters Canada

The United Verde Extension, a United States copper syndicate, has taken over the Murray property situated between the Noranda and the Richardson group in Rouyn township, Quebec. The deal is stated to involve a payment of $300,000, the company further agreeing to spend an additional sum of $200,000 for development purposes for what is understood to be a 90 per cent interest in the property. It is further proposed to expend the sum of $50,000 immediately.

Phelps Dodge Options Bonney Mine

The Phelps Dodge Corporation has taken a formal option on the Bonney Mine, 5 miles southwest of Lordsburg, N. M. The property involved consists of seven patented claims owned by the Bonney Mining Co., and some outside ground owned by individuals. For several months the matter has been under consideration, and preliminary examinations down to the present water level, 310 ft., have been made by Gerald Sherman, E. M. Sawyer, and A. A. Leach, of the Phelps Dodge staff.

No. 2 shaft, 500 ft. deep, is being retimbered under the direction of Joseph Lutz, of Bisbee, and the work of unwatering will begin at once. A 200-gal. bucket bailer is being used for the purpose.

The property is developed by three shafts on the main vein, 375, 400, and 500 ft. in depth, respectively. The 400 level is opened upon the vein for a distance of 1,000 ft. For 400 ft. of this distance the vein has a width of 10 ft. The 500 level is opened for about 600 ft. on the vein, with ore in both faces. There is a total of 5,000 feet of development work on the property and 60,000 tons of silver-copper ore in sight above the 500 level.

The Bonney ores are siliceous, carrying gold, silver, and copper, and are identical in composition with, but of a much higher metal content, with a wider vein than, those of the 85 Mine, which adjoins the Bonney and which was purchased about five years ago by the Calumet & Arizona Mining Co. Several thousand tons of ore has been shipped from No. 1 shaft of the Bonney by leasers during the last three years, the average being about $12 gold, 6 oz. silver, and 8 per cent copper. The owners, however, have never allowed the main ore reserves to be encroached upon. E. M. Sawyer, general manager of the Burro Mountain Copper Co., at Tyrone N. M., is in charge of work at the Bonney mine.

Abandoned Gem Mine to Be Reopened

The old Gem mine, of Orient, Wash., located nearly thirty years ago, and which had a varied career, including early development, two years of shipping, lack of capital, abandonment, a long period of idleness and relocation, has been put into a new corporation known as the Gem Gold Mines, which will install machinery and open the property at greater depth. Charles Clark, of Spokane, is president. When the property was first located it had a six-inch lens of unusually rich free gold ore, which caused many other claims to be located in the vicinity. The ore disappeared at a depth of 85 ft.

California Mining Activities

At the Rising Sun mine, west of Colfax, Calif., a drain adit is being driven from the Bear River, a distance of 2,200 ft., to connect with the mine workings and afford drainage. The mine is served by a 600-ft. shaft. A steel headframe is to be installed and recently modern equipment was provided for hoisting and compressed air service. The adit has reached a length of 1,300 ft. The mine is controlled by the Premier Mines Corporation.

The Merrifield property, Nevada City, has been bonded by the Belmont-Uncle Sam Mining Co. of Nevada. Development and exploration is being continued.

The Washington Mining Co., operating a mine on the east belt of the Mother Lode in Calaveras County, has been reorganized and control has been acquired by J. F. Peters and his associates. The new management is expected to increase present milling capacity from 40 tons to 70 tons. The shaft has reached a depth of 600 ft. and recently production has been made.

The Swauk Mining District, Washington

By. A. Franchie
Seattle, Washington

The electric gold dredge of the Kittitas Dredging & Mining Co. has proven that the Swauk mining district, Kittitas County, Wash., has mineral deposits worthy of development. There are many faults in the Cascades. Not a diamond-drill hole of any depth has been sunk in the Cascade mineral belt. There are faults in Montana, Idaho, Nevada, and other mining states, but in these states prospecting with diamond drill is practiced. Too many promoters do not want diamond drilling or mining —merely the people's money.

The Kittitas dredge has operated since Feb. 22, 1926, and has produced one brick of gold a week ($10,000 to $12,000). Soon another dredge will be added. The present one is equipped with 7½ cu.ft. buckets. The second one will be of larger capacity.

Several properties have been sold or leased in recent months. The Hope mine, the Nellie, the Red Cross, the Verden group, the Grizzly Bear group, and many others have some rich ore, and some have yielded profit to their owners, in small-scale mining. The Great Northern Tunnel, at Scenic, is reported as having cut through several orebodies of large size.

The copper belt extends through the Cascades from California, through Oregon, Washington, and into British Columbia. This state with proper development may prove to be as rich as California, but capital and real miners are necessary to bring results. Scientific exploration and men who want to work and develop this country are needed.

The Swauk formation on the surface is mostly a sedimentary deposit of sandstone and shale with diabase dikes as an intrusive. Peridotite, also classed as an intrusive, has altered to serpentine, and at many places the traces of peridotite have completely disappeared. I think that this serpentine, which is of the Carboniferous period, is the bottom formation of this region and where the large orebodies are located. The Blewett mine, for instance, on the east side of Blewett Pass, and the Grizzly Bear mine, on the west side, are in the serpentine, and both have produced good ore. The quartz which forms the vein in the serpentine not only fills the fissures, but mineralization extends in many places into the serpentine, thus forming good low-grade ore. The Swauk mining district has promising possibilities.

Kittitas electric dredge

Tailings from Kittitas dredge

Quapaw Indians File Suit for Proceeds from Ore

Ten Quapaw allottees have filed suit for recovery of proceeds from lead and zinc ore taken from Quapaw Indian lands in the Joplin-Miami district since 1921 and valued at between twenty and thirty million dollars. The suit was filed in the federal district court at Tulsa, Okla.

It is charged in the petition that Albert B. Fall, former Secretary of the Interior, executed the leases over the protests of the Indians, and on a basis lower than other offers at the same time, and lower than the Interior Department's estimate at the time as to what a fair price would be.

The Eagle-Picher Lead Co., the Hunt Mining Co., the Commonwealth Mining Co., the Keltner Mining Co., and the White Bird Mining Co., sublessees of the Eagle-Picher Lead Co. and Geo. W. Beck, Jr., are named as defendants.

White Delf Makes Regular Shipments

The White Delf mine, at Clark Fork, Idaho, is shipping two and three carloads of ore a week, and the returns are reported at $2,500 to $3,000 a car. Anderson, of Spokane, has a lease on the upper workings, and has four feet of galena, and other leasers are said to have good ore. The adjoining property, the Elsie K., is working three shifts, and making regular shipments.

Townsite for Porcupine Paymaster

Another townsite is being surveyed in the Porcupine district of northern Ontario in connection with the plans of the Porcupine Paymaster mine for expansion of its operations. The new townsite will be located between Timmins and South Porcupine and will be within five minutes' walk of the main Porcupine Paymaster operations. The erection of employees' homes will start soon.

British Columbia Mines Declare Dividends—Allenby Copper Plans New Mill

Silversmith Mines has declared a dividend of $50,000, covering operations for the first quarter of its fiscal year, which commenced on June 1, and bringing its total disbursement to date up to $725,000. Development on the Slocan Star and Silversmith shoots is reported to be entirely satisfactory.

Whitewater Mines has declared a dividend of 15 per cent on its $100,000 issue of preferred stock, covering operations for the third quarter of this year; a first dividend, one of 10 per cent, was paid at the end of the second quarter of the year. When 100 per cent has been paid on this issue it becomes automatically converted into common stock, of which 900,000 shares at $1 par have been issued. Since the beginning of this year up to September 7 the company has shipped 5,833 tons of milling ore, 20 tons of clean galena and 20 tons of clean zinc-blende; the milling ore averaged approximately eight per cent of lead, eight ounces of silver per ton, and 16 per cent of zinc; nearly all of it was drawn from the 1,600-foot level, which is the deepest commercial working in the Slocan.

Lucky Jim Lead & Zinc Co., which has shipped more than 13,500 tons of ore to the custom concentrator at Trail since the beginning of this year, is planning to re-model the Lucky Jim Rosebery mill, to increase capacity to 300 tons per day.

Commencing with the dividend for the third quarter of this year, the Howe Sound Co. has announced its intention of raising its dividend rate up to $4 per share from the previous rate of $3 per share.

The Allenby Copper Corporation, a subsidiary of the Granby Consolidated Mining, Smelting & Power Co., has been speeding up production recently at its Copper Mountain mine, in the Boundary district, and the mill now is operating at close to its rated capacity of 2,000 tons per day. The ore averages 1.85 per cent of copper, and carries also low gold and silver values. The directors of the Granby company are said to be so pleased with the results that are being attained at Copper Mountain that they contemplate increasing the capacity of the mill.

News From Washington

By PAUL WOOTON
Special Correspondent

Operating Economies Developed by Bureau of Mines, in Co-operation with Mining Companies

Despite the depression through which the metal mining industry has passed in recent years there has been no lowering of standards in the employment of directing personnel, field men of the Bureau of Mines report. While the situation has been such as to require rigid economy there has been no tendency to reduce expenses by placing operating activities under inexperienced or mediocre men. It is apparent also that the day of the hard-boiled non-co-operative individualists on the mine staff is over. They have been supplanted by men who study their jobs and analyze conditions. Problems that arise are put up for discussion among all concerned. It is being found that a solution arrived at jointly generally is acceptable to all. The day has come when ability to co-operate is just as much a requirement as knowledge of the particular job.

With the mines under intelligent direction it has been found possible to put through real economies. Great help in that direction has been secured on many properties by doing away with tonnage costs as a basis of accounting, the Bureau men find. Mining costs now are expressed in terms of the value of the product. In copper mining particularly this has been carried to the point where the cost per pound of copper is figured for each stope. If it is found that production from any stope does not give the necessary margin of profit, it is placed in reserve. A record is kept showing the price level that must be reached before that particular part of the mine can be worked to advantage. It no longer is a question of waiting to see what the profit will be. The operating staff knows that in advance.

Application of the contract system has been productive of economies in some mines. Sorting underground is being done more and more. It reduces hoisting and decreases the cost of filling. If only the larger pieces of waste are removed underground the aggregate of the saving is considerable. Reduction of the number of shafts operated has been very effective in certain large properties. Where possible, operations are being concentrated and the mine worked under a carefully prepared general plan. These are some of the benefits which have been brought about by the depression. While it has had the effect of putting metal mining on a more efficient basis the benefits have been small when compared with the heavy losses that have been suffered.

Senators Want to Investigate Pabst Mine Accident

Pressure is being brought by certain Senators looking to a federal investigation of this disaster. The feeling in official circles seems to be that this is a state matter. The federal government through its voluntary assistance already has co-operated in an important way. A Bureau of Mines rescue car and a crew headed by the district engineer gave all the assistance they could until the last man was rescued.

Potash Exploration Meets Obstacles

The potash exploration act as passed by Congress imposes restrictions on the property and mineral rights of land owners which will make it very difficult to secure drilling privileges in some areas, but it is hoped that some modification of the interpretation placed upon the act will make it possible for property owners to accept. Negotiations to that end still are in progress with some promise of a favorable result.

James S. Roth, of New York, has been appointed a supervising engineer of the Bureau of Mines, effective October 15. He will be in immediate charge of the potash exploration work.

The fact that the Bureau of Mines is to drill some wells of its own in the search for potash does not mean that there will be any less attention paid to the oil wells which are put down in the Southwest. Efforts have been made for years to take advantage of the wells being drilled for that purpose but the methods of drilling and the pressure under which the wells are put down make impossible the securing of accurate samples.

Polish Zinc Production Less Than In 1925

According to the U. S. Department of Commerce, Polish zinc production amounted to 91,125 metric tons in June, 1926, compared with 87,900 in May and a monthly average of 93,300 in 1925. Most of the production comes from Polish Silesia.

Polish production did not satisfy local demands for zinc ore during June, and 9,463 tons were imported, the largest monthly importation for a considerable period. June exports of raw zinc and products were 9,688 tons in June, compared with 11,600 in May.

Government Begins Production of Shale Oil

Actual production of oil from Colorado shales has begun at the new experimental plant of the Bureau of Mines near Rulison, Colo. Investigations of the treatment of oil shales conducted by the Bureau of Mines over a period of ten years, in co-operation with the states of Utah and Colorado, and the work of other agencies, have aroused much interest in these shales as a commercial source of oil. At the suggestion of the committee appointed by the President to determine the possibilities of a future supply of oil for the Navy, Congress appropriated $90,000 to the Bureau of Mines in March, 1925, for the construction and operation of a pilot oil-shale plant and the purchase and mining of shale. The site selected for the plant is 1½ miles southwest of Rulison, in Garfield County, Colo., on Naval Oil Shale Reserve No. 3.

Mason Copper Developing Property in Johnson Camp

The Mason Copper Co., which recently took over the interests of the Arizona United Development Co., Johnson, Ariz., in the Little Dragoons, is putting the buildings in shape preparatory to starting active development work. The main shaft is down to the 1,300 level.

Silver-Lead Ore in Northwest India

Silver-lead, copper, and mercury ores and alluvial gold are found in the vicinity of Chitral in the Northwest Frontier Province of India, which is a part of the Hindukush and Himalaya Mountains. The mineralized area covers about 5,800 square miles. A concession on a part of this area has been obtained from the Government of India by Chbotalal Ishwardas Parskb, Post No. 7, Bombay, India. He proposes to form a syndicate for the development of the property. Messrs. Hughes & Davis, metallurgists, have made analyses of the silver-lead ore, which contains not only a high percentage of silver but also gold and antimony.

Twenty-two Tailing Mills in Joplin-Miami District

More than 400 tons of zinc concentrates are being recovered every week in the Joplin-Miami district by plants that are treating tailings exclusively. There are twenty-two of these mills in operation. The latest to start up was the New Chicago Mines Corp., No. 4, at the old Premier mine. It is the largest tailing mill in the district. The check-up on tailings plants was made recently by J. D. Conover, secretary of the Tri-State Zinc and Lead Ore Producers' Association, and his findings are in harmony with the statement of Charles F. Williams, of the U. S. Geological Survey, who recently said that approximately three per cent of the zinc production on Indian lands in this district is from re-treated tailings.

Zinc Prices Stimulate Activity in Joplin-Miami District

Under the stimulation of fair zinc and lead ore prices, activity in the Joplin-Miami district is being well maintained.

The Lawyers Mining Co., Oklahoma City, Okla., is starting the erection of a 350-ton mill on the DeArmond lease, north of Picher, Okla. Development of the DeArmond lease has been under way about a year.

A company represented by James Purcella, of Joplin, is building a small mill on the old Beef Branch lease, south of Joplin. Considerable drilling has been done on the tract.

The Admiralty Zinc Co., Douthat,

Okla., has started its new mill in the Belville, Mo., district, northwest of Joplin. Water has been lowered to the 125-ft. level by the Admiralty Company, and this has had the effect of encouraging activity on the part of a number of small operators. The section has always been troubled with water. The Admiralty Company also is planning considerable activity on its lease of the Bankers' land, south of Joplin.

The S. R. & W. Mining Co., Miami, Okla., has obtained a lease on the Farmington mill, at Hockerville, Okla., formerly operated by the Federal Smelting & Refining Co., and expects to place it in operation in the near future.

The Golden Rod M. & S. Co., Joplin, Mo., has been granted an extension of time for its drilling option on the Landreth fee, near Central City, west of Joplin.

Mountain Meadow Makes First Shipment

The Mountain Meadow mine, near La Plata, Colo., owned by the Mountain Meadow Mining Co., Durango, Colo., made its first shipment of silver ore Sept. 20 after five years of development work. The mine has a 15-ft. vein of mill-grade ore.

U. S. Vanadium Sells Rifle Plant

The Union Carbide Co. has purchased the properties of the United States Vanadium Co. at Rifle, Colo., which consist of a vanadium mill and properties adjoining. However, the United States Vanadium Co. is enlarging the mill before turning it over to the Union Carbide Co. and the transfer will not take place until the construction work is completed. The new mill when in operation will be able to handle approximately 140 tons of ore per day.

New Feldspar Mill in Denver

The Western Feldspar Milling Co., 1350 West Maple, Denver, Colo., has announced plans for the construction of a new reduction plant to be situated on its present Denver property. This company has been operating an experimental plant which has been producing about ten tons of feldspar a day, and on the basis of the present experiment has decided to increase its production.

Gold Discovery Near Del Norte, Colo.

A gold strike which has evidenced considerable interest has been made near Del Norte, Colo., in the Summitville territory. Judge Jesse C. Wiley of Alamosa, Colo., heads the company which has been active in this district. The strike was made in an outcrop that rises about eight feet above the ground in the form of a miniature peak and is about twenty feet in circumference. A shipment of 650 lb. of rock was made as a trial and the assay proved of sufficient value to continue development. A similar strike 300 yd. distant heralded the original discovery of gold in the Summitville district in 1872.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Drop in Silver Prices Felt at Canadian Mines—Kirkland Gold Starts Mill

Toronto, Oct. 1—The recent drop in the price of silver is a matter of serious concern to the silver mines in Northern Ontario. While it is doubtful if it will actually result in the closing down of any properties, it will have a considerable effect on profits. It is understood that the McKinley-Darragh-Savage will close down in the comparatively near future and while this decision has no doubt been hastened by the drop in the price of silver, it is not the primary cause, as it was hardly expected that the property would in any event operate through the winter. Other companies are in a more fortunate position. Representative costs for some of the larger operators indicate that even at present prices the companies are able to make a substantial marginal profit. Last year the Mining Corporation costs were 46.8c. an ounce; Nipissing Mining, 45.8c.; Keeley Silver, 30.4c., and Castle-Trethewey, 30c.

Some of these companies can probably increase their profits over the indicated margin by treating a higher-grade ore. The operators are inclined to believe that the drop in the price of silver has been somewhat overdone and that a reaction may be expected. From the shareholders' point of view, however, the matter is serious enough, as silver stocks have fallen in price and dividends may perhaps be affected. At the annual meeting of the Castle-Trethewey held in Toronto a few days ago, it was stated that the position of the silver market at the present time is a strong reason against taking up the question of dividend payments.

A new company has been formed in Cobalt known as the Keweenaw Silver Mines, with a capitalization of 1,000,000 shares of $1 par. The new company will take over a group of claims in the west part of the Cobalt Camp, in some of which the Temiskaming Mining Co. is interested. It is understood that 400,000 shares will be turned over to the vendors of the different properties and will be divided pro rata to the extent of the Huronian formation showing on the different groups.

Recent Copper Discoveries Reported

New copper discoveries are reported in the Townships of Clifford and Ben Nevis on the Ontario side of the Quebec boundary. These townships lie in the Kirkland Lake Gold belt. In view of the rich copper ores which are being found in the Argonaut mine there is no reason why similar deposits to those of Quebec should not be found in Ontario. Very few details are as yet available regarding the new discoveries.

Kirkland Gold Mill Starts

The mill of the Kirkland Lake Gold Mining Co. started operating on Oct. 1, after a shutdown of several years. The mill has a capacity of 150 tons a day, and developments on the property to a depth of 2,275 ft. indicate that a profitable grade can be treated. The only question is one of the extent of the orebodies, as very little ore has been found on these lower levels west of the shaft. It should be noted however that very little development work has been done to the west and there is no reason why further discoveries should not be made. The shaft is down below 2,300 ft., which is the greatest depth in Kirkland, and at the 2,300-ft. level a crosscut has intersected a vein, but has not yet reached what is believed to be the favorable ore horizon. In the meantime the fight for the control of the Beaver, which involves the control of the Kirkland Lake Gold, goes merrily on. J. B. Tyrrell has issued a writ against F. L. Culver, President of the Beaver, charging libel and claiming damages unless a retraction of the statements on which the action is based, is made. Mr. Culver refuses to apologize or retract and proposes to fight the matter out. The action by Mr. Tyrrell arises out of the statement in the Beaver report that it was on Mr. Tyrrell's report and recommendations that the work on the Beaver Auxiliary property was done. The opposing faction to Mr. Culver, which is seeking control of the company, alleges that it is a waste of money to do any work on the Beaver Auxiliary.

Crystal Copper Leases Goldsmith Mine

Stockholders of Crystal Copper Co., Butte, Mont., were asked to vote on Oct. 2 on a proposition to lease the Goldsmith mine to W. A. Clark, 3rd, for a period of 23 years. Terms of proposed lease are that neither party thereto can cancel during the first three years and during that time Clark must have performed 600 shifts of work each three months. After the first three years Clark is to perform $15,000 of work each three months, all work specified to be actual underground mining. The Crystal Copper Co. is to be under no expense for mining operations and is to receive royalty, on a sliding scale, from all shipments. The Goldsmith property was purchased a number of years ago and the ground paid for from shipments. It is situated northwest of the Moulton property of the W. A. Clark estate. Last winter the surface equipment at the Goldsmith was destroyed by fire. A contract was given to the Butte Machinery Co. to replace the burned equipment and the installation was recently completed under the supervision of P. A. Brady, superintendent.

Neihart District Active

There is now more activity in the vicinity of Neihart, Cascade County, Mont., than there has been in some time past. Burr Leyson and associates are shipping from the "Queen of the Hills" group, and eastern parties are negotiating for the Savage mine, lying close to the Silver Dyke property of the American Zinc, Lead & Smelting Co. R. E. Payne of Boston has been acquiring properties close to the Silver Dyke, and other Massachusetts interests have acquired the Broadwater and Cascade properties from H. L. Maury, of Butte.

Sonora Development Makes Strike in Wickenburg District

The Sonora Development Co., operating the old Congress mine, Congress Junction, Ariz., is reported to have made a rich strike of lead and silver ore in the Newsboy group of claims, southwest of Wickenburg, in the vicinity of the old Vulture mine. The ore is said to be of the same type as that found in the O'Neill mine of the Tonopah Belmont Development Co.

A flotation plant and concentrator will probably be built. The machinery for the new shaft is being purchased and it is expected the shaft will be completed in approximately three months. The ore will be trucked to Hot Springs Junction, and shipped to the Hayden smelter.

McIntyre Porcupine Increases Reserves

At the annual meeting of the shareholders of the McIntyre Porcupine of northern Ontario, President J. P. Bickell stated that there had been a substantial increase of the ore reserves, the amount of broken ore being 94,000 tons greater than in the previous fiscal year. The cost of treating the ore had been reduced to an average of $4.60 per ton as against $4.81 per ton in 1925. No. 11 shaft was now down to a depth of 3,350 ft. and it is expected that the present objective, 4,150 ft., will be reached before the end of next March.

Canadian Quartz Production Up 30 per Cent in 1925

Production of quartz (silica) in Canada during 1925 was considerably higher than the total recorded in the preceding year. According to the Dominion Bureau of Statistics at Ottawa, shipments of quartz during 1925 reached a grand total of 197,224 tons valued at $363,612 as compared with 150,896 tons at $323,156 shipped in 1924. Capital employed by the fourteen firms operating in the Canadian quartz industry was $1,005,159. Employment was furnished 15 salaried employees and 138 wage-earners.

Canada Increases Output of Asbestos

The Sherbrooke district in the Province of Quebec, which supplies more than 80 per cent of the total world production of unmanufactured asbestos, most of which is imported by the United States, is increasing its output of that product, according to the U. S. Department of Commerce.

The 1925 production of unmanufactured asbestos in Quebec amounted to 273,522 short tons, valued at $8,976,645, compared with 208,762 tons, valued at $6,561,659, in 1924, showing an increase of 31 per cent in tonnage and 37 per cent in value in 1925. An average price of $32.82 per ton in 1925 and $31.37 in 1924 is indicated, in spite of the fact that the average price for the fine grades of crude asbestos was lower in 1925 than in 1924.

Extraction of ore for 1925 was reported to be very satisfactory. It amounted to 129.7 lb. of asbestos fiber per ton of rock mined, compared with 124 lb. per ton in 1924 and 117 in 1923. The increased extraction is said to have resulted from improved machinery and methods of handling the ore.

Quebec production formed approximately 84 per cent of the world total in 1925, and about 82 per cent in 1924. The next largest production was 34,349 tons from Rhodesia, with Russia third. Both these countries, and some others, greatly increased their production in 1925, but the Canadian output advanced simultaneously to an amount which gave it the same relative proportion as in previous years.

O'Brien Mines Company Acquires Additional Mineral Land

There is a prospect that the productive area of the Cobalt Lake district of Northern Ontario may be substantially extended, as a result of geological data gathered by the O'Brien Mines Co. At the O'Brien mine and other properties in the same locality, the zone of mineralization follows in close proximity to the lower side of the diabase sill. This sill has a sharp pitch downward to the east, and mining has been carried to a depth of 1,000 ft. at a number of points. It was supposed that the sill would continue its downward pitch indefinitely. Officials of the O'Brien, however, concluded that the sill might flatten out, and afford profitable territory for mining to the east. Accordingly diamond drilling was undertaken on a claim a short distance east of Cross Lake, with the result that the diabase sill took an upward roll, the contact being about 500 ft. below the surface. Having acquired this information operations on the claim were discontinued, and during the last two years the company has been quietly buying a large number of claims in this locality, at an average cost of about $3,000 each. The prospect of a considerable extension of the producing area of the camp is regarded as highly encouraging.

Tonopah-Canadian Operating at Full Capacity

The new mill of the Tonopah-Canadian, Gowganda, Ontario, is operating at a capacity of about 60 tons of ore daily. The ore being treated at present is largely from the dumps and contains approximately 40 oz. of silver to the ton. It is officially stated that the general average of the ore obtained underground is approximately 60 oz. of silver to the ton. After reserving the high-grade ore, the average mill ore carries about 40 oz. to the ton.

Hope Metals Plans Power Plant and Mill

The Hope Metals Co., Christmas, Pinal County, Ariz., will soon undertake the erection of a mill and the installation of a power plant. Alfred L. Flagg, of Phoenix, is the engineer for the company, and A. W. C. Bowen of Providence, R. I., president. The ore contains silver, gold, and lead. Flotation will be used. A semi-Diesel power unit at the railroad, less than a mile from the mines, is planned.

Consolidated Mining & Smelting Enlarges Zinc Reduction Plant

The Consolidated Mining & Smelting Co. of Canada will enlarge its zinc-reduction works, which will bring daily capacity to 275 tons. It will also double its custom zinc-lead mill at Tadanac from 300 to 600 tons' capacity, and will install a concentrator at St. Eugenie mill to permit re-treatment of old Sullivan dumps. Two steam-driven turbo-generators, each of 1,500 kw. capacity, will be installed at the Sullivan concentrator. Extension of the lead refinery will be completed next month, raising capacity to 400 tons per day.

Plans Under Way to Operate North Carolina Gold Mines

W. N. Wright, of Memphis, Tenn., is reported to be organizing a $500,000 company to operate several old gold mines in Rutherford County, N. C. Wright and others have obtained an option on a large acreage of land, and plans are going forward to dredge the ground, according to advices from Rutherfordton, N. C. This project will be the second of its kind to be attempted in North Carolina within the next few months. P. F. Sturgess and others have announced plans for mining in the hills of Franklin County.

Clericy Mines, Ltd., Organized

The Keno Syndicate, Ottawa, Ontario, has been making considerable progress in Northern Quebec during the past season, with properties in Clericy, Dufresnoy and Boischatel townships. The holdings of this syndicate total 3,000 acres and a company known as the Clericy Mines, Ltd., has been organized to proceed with development work on a substantial scale. The various properties are located in six groups and include holdings near the Waite-Montgomery, and the Archean Mines. Some very good showings have been opened up in one of the groups in Clericy Township where a sheared zone nearly 150 ft. wide has been exposed with substantial gold values.

Canadian Mining Districts Linked by Good Highways

Premier Ferguson of Ontario recently announced that by this time next year the provincial highway system connecting Cobalt, Kirkland Lake, Porcupine, Cochrane, Kapuskasing, and as far west as Hearst will be completed, connecting these and other main northern points with the south. This will mean the opening of the north's immense resources in mines, timber, water powers, and fertile lands. The benefit will not accrue to Ontario alone, for a branch road from Cobalt connects with the Angliers-Rouyn-Makamik road which the Quebec Government is building through the rich Rouyn mining field and the Temiskaming colonization area.

Comstock Merger Mills $4.45 Ore

The Comstock Merger Mines, Inc., Virginia City, Nev., milled 40,860 tons of ore in August which ran $4.45 per ton. Bullion shipped was 4,539 oz. gold and 137,992 oz. silver, with an estimated value of $176,619.

Johannesburg Letter

By John Watson
Special Correspondent

Renewed Interest in Barberton District—Fire at Brakpan

Johannesburg, Aug. 24—The Chamber of Mines has invited all members of the Union Legislative Assembly who did not participate in last year's visit to the gold mines of the Rand to come to Johannesburg in October.

There has recently been somewhat of a revival of the gold-mining industry in the Barberton district, where modern methods are to be applied to treat refractory ores. Recent government statistics show that there are six large and five small producing mines in the Barberton region. These are equipped with 100 stamps, and six tube mills are working. For the first six months of the present year the value of gold produced totaled £120,902. For the last five years the figures have been:

	Tons Milled	Yield in Oz.	Value
1921.....	53,500	25,540	£108,065
1922.....	75,800	36,068	153,210
1923.....	127,200	46,802	198,801
1924.....	104,800	41,712	177,180
1925.....	90,300	43,098	182,694

Fire at Brakpan

Early on the morning of Aug. 16, a fire was discovered in the Brakpan mine, where the remains of a burning candle had apparently ignited a timber pack in the mine. Four natives were fatally gassed and about eight Europeans and eighty natives were also gassed, receiving treatment in hospital or with an emetic. Donald A. King, shift boss of the section, was one of the first to descend and explore the scene of the disaster; he was active in rescuing the gassed miners and natives, getting badly gassed himself. The area of the fire was sealed off, to prevent access of air. All the men who were gassed were allowed a week's leave without loss of pay.

Diamond Rushes

Two notable "rushes," to peg ground for diamond working, took place in the Lichtenburg district last week. At Vaalboschputte, on Aug. 16, over 8,000 runners took part. The length of the run varied from 1,000 yards to more than two miles, according to the sites selected. The weather was fine and about 120 police were present, to keep order and see that the regulations were carried out. This new farm adjoins Elandsputte. On Aug. 19, on Baker's farm, Treasure Trove and Ercildowne were proclaimed. About 11,000 licences were taken out, and the line-up, preparatory to the rush, extended over a length of a mile and a half. The Mayor of Lichtenburg was interviewed last week by a *Star* representative, and he said that the opening of these diamond fields had been a great boon to the district. A proposal is being considered to hold a system of lottery, to take the place of future "rushes," for allocating claims for alluvial diamonds.

On the Johannesburg Stock Exchange during the last week the share market has been active and quiet, by turns, London business being less than usual. Sub-Nigels have again been the leading feature, but they dropped in price from 60s. to 55s. 3d. during the week. Gold shares have, on the whole, been steady, with a fair amount of inquiry. T. C. Lands were very quiet. Potgietersrust platinums were fairly active, the price remaining about 9s. 3d. per 5s. share. Onverwachts fell during the week from 19s. 9d. to 18s. 10½d. per 10s. share. Transvaal Platinums were on offer at 7s. 6d., with no buyers.

Arvida Aluminum Production Estimated at 50,000,000 Lb.

The plant of the Aluminum Company of America, at Arvida, Canada, was opened for inspection to a party of American and Canadian corporation presidents and financial and industrial executives during the last week. They were the guests of Arthur Vining Davis, president of the company.

The visitors learned that 6,000 workmen will eventually be employed at the plants already constructed or in course of construction. The manufacture of aluminum has started, and it is expected that 50,000,000 lb. will be produced this year at Arvida.

Importation of bauxite direct from British Guiana will start soon, but in the meantime aluminum is being transferred from East St. Louis and gets its final process here. In three months 300 houses have been erected and two churches are being built.

Zinc Smelter Near Saguenay Proposed

Concurrent with the announcement that the Duke-Price interests in the province of Quebec have decided to start without delay the harnessing of the power resources of the Chute-a-Caron on the Saguenay River, comes the report that construction of a smelter in the vicinity of the Saguenay will be started next spring. As practically the entire developed power of the district is now employed in other industries, it is believed that realization of this project, which has been talked of for some time, will come with the harnessing of the huge hydraulic wealth of the Chute-a-Caron. Construction of a hydro-metallurgical plant at a cost of $12,000,000 is the plan under consideration.

The proposed plant would be used as a zinc smelter and as a general metal refining establishment. Impetus to the scheme is given by the developments taking place in the Rouyn mining area in the northwestern part of the province. The smelting plant being erected at Rouyn will only perform the preliminary process, whereas the proposed Saguenay plant would be equipped for final refining.

Plymouth Discovers Oreshoot

At the Plymouth property of the Argonaut Mining Co., Plymouth, Calif., a new oreshoot said to be 16 ft. wide and yielding samples around $33 per ton has been cut on the lower level and is being explored. This discovery promises greater activity at the Plymouth property.

London Letter

By W. A. Doman
Special Correspondent

Rand Selection Refinanced—Tin an Important Factor in London Market

London, Sept. 21—Owing to the fact that the Anglo-American Corporation of South Africa owns about 90 per cent of the capital of the Rand Selection Corporation, the shares of that organization have not been very largely dealt in for some time. Now, however, the situation will probably change, for the Anglo-American Corporation has entered into an agreement to lend the Rand Selection up to £1,000,000 during the next five years, each concern to have a 25 per cent interest in any new business which may be obtained by the other. In consideration for guaranteeing the issue the Consolidated Mines Selection (an affiliated company) has a call for about a year on 1,200,000 5s. Rand Selection shares at 17s. 6d. per share. There does not seem to be much risk involved in the guarantee. Part of the Anglo-American holding of Rand Selection shares will be offered to its own shareholders at the rate of one in four, at 16s. 3d. (present price 23s. 9d.) and part to Rand Selection shareholders at the rate of one in two, also at 16s. 3d. per share. All the companies are interested in several of the big Far Eastern Rand undertakings, including Brakpan, Springs Mines, and West Springs; also in Consolidated Diamond Mines of South West Africa. I am inclined to think that some of the "new business" referred to will be in connection with the diamond industry, in which the Anglo-American with the De Beers people hold the leading position. Touching on diamonds, rumors are pretty frequent of new discoveries, and it is suggested, perhaps not altogether jocularly, that certain companies have a "nuisance value" to the big combination.

A new manganese-mining undertaking has just made its appearance. The sphere of operation is in the Gold Coast, where the African Manganese is already established, but so far without meeting with any great success, no dividend since the 10 per cent distribution in 1924 having been paid.

As I suggested a week or so ago would probably be the case, the Falcon Mines is exercising its option on the M'Tuga property, in Northern Rhodesia. The purchase price is £50,000, payable half in cash and half in fully paid shares.

Interest in Mr. Bleloch's Boksburg Gap (Far East Rand) theory is fizzling out, and the latest assays from the different boreholes give no better results than the earlier ones; they all indicate ore of too low grade to work.

The excitement in tin has continued, and the price has risen to £316 12s. 6d., though at the time of writing it is back to £312 5s. per ton. The strange thing is that despite the sustained advance some companies are either paying reduced dividends or none at all. It might have been thought that the high

price would stimulate production, but it does not appear to have done so. The effect so far has been seen in the capital market, numerous companies having come into existence, and these cannot add to the production of the metal for some months yet. Experts state that they foresee, with fluctuations, an even higher price, as demand from the Continent will be added to the home requirements, and no new sources of supply are being tapped.

Miners Wanted in New Mexico

Captain R. R. Allison, superintendent of the Anita Copper Co., Lordsburg, N. M., and who also operates the Last Chance mine, in that district, reports a shortage of miners. The Last Chance is working thirty miners at present and the management wishes to double the force. The Anita company is sinking a shaft to the 750 level on the Nelly Bly property and working twenty miners, but desires to increase the number to a total of forty.

A One-Man Mine

For a number of years Frank G. Clein, Lordsburg, N. M., has operated a small gold property at Gold Hill, 15 miles northeast of Lordsburg, in the Little Burro Mountains. His is a self-contained operation, for he mines, hoists, hauls, and mills his own ore and retorts the scrapings from the plates. His mill is a nondescript affair, and operated by an engine from a discarded flivver. His last run, representing two months' work, consisted of twenty-four tons of ore, which produced a bar of gold that sold at the bank for $1,200.

Dip Needle Prospecting for Copper in Northern Michigan

For the first time in the history of the Michigan copper district, dip needle experiments are being conducted to determine the practicability of this method of exploration. The State Geological Survey of Michigan is co-operating with the mining companies in this work. The initial tests are being made in known mineral areas to ascertain how the results check up with map and other data of copper bearing veins. Copper Range and Calumet & Hecla areas have been selected for this purpose. If the experiments are satisfactory, the method will be extended to unproved areas as a means of locating the most likely copper bearing sections.

Ankerite Ore Difficult to Crush

At the Ankerite mine, Porcupine area, Ontario, which is being operated by the Porcupine Goldfield Development & Finance Co., Toronto, the output has been limited by reason of difficulties in milling. The mill was started about the middle of June with a tonnage of 125 to 150 tons a day, which has gradually increased to 200. Trouble has been experienced with the crusher, the ore being exceptionally hard. The company is now endeavoring to work out a satisfactory method of grinding. Development work is under way on the No. 5 vein at the 475 level.

Mexico City Letter

By W. L. Vail

Special Correspondent

Road Construction Aids Geologists—Ten Mining Districts Established

A special commission working under the Department of Commerce, Industry and Labor has made public the results of recent investigations in portions of Tepic and Jalisco which establishes the existence of an extensive mineralized zone crossed by the new Southern Pacific Railway of Mexico. The principal formation is basalt. Over this comes rhyolite and andesite deposits and the report assumes that important mineral deposits may be found underneath. Work of excavation and tunnels on railway construction were of great assistance to the geologists prosecuting this work. Another commission from the same Department will report on the country adjacent to the new highway between Durango and Mazatlan.

White arsenic shows a production of 3,914 tons during the first six months of the current year, a large portion of this coming from Mapimi, belonging to the Penoles company. While the present prices are low, owing to German competition, the production is steadily increasing. A considerable portion of the output is held in storage. With the exception of gold production which shows an increase of only 303 kilograms the output of all other minerals was considerably in excess of the output for the first six months last year. The July output of minerals this year amounted to 23,814,936 pesos as against 22,874,881 for July last year.

Ten Mining Zones

For the purpose of assisting the work of the Bureau of Mines, the Republic has been divided into ten mining zones, wherein will be installed a local inspector. This is presumed to greatly facilitate the work of the mining department, as well as being of practical value to mine operators. Many matters which have hitherto been taken up in the City of Mexico may be handled at the local office, saving time and expense. The zones follow: (1) Lower California and Sonora; (2) Chihuahua; (3) Nuevo Leon, Coahuila, Tamaulipas, San Luis Potosi and the Mazapil district of Zacatecas; (4) the remainder of Zacatecas and the states of Aguascalientes and Durango; (5) Nayarit and Sinaloa; (6) Jalisco and Colima; (7) Guanajato and Queretero; (8) Hidalgo; (9) Michoacan, Mexico, Morelos and Guerrero; (10) Puebla, Oaxaca and Veracruz.

The Mexico Mines Supply Company has secured possession of La Castellana, Guanajatillo and Zacatecana mines, state of Zacatecas, with the San Ramon and Castellano plants and water rights, real estate, etc., formerly belonging to the Castellano Mines Co., under foreclosure proceedings. The claim of the Mexico Mines was for 72,000 pesos and the property went under the hammer for 40,000 pesos.

A strike has been declared at the Boleo mines in Lower California because of a difference of opinion as to whether the labor unions or the mine owners should pay salaries of special mine inspectors appointed by the unions.

Damage Claims Due to Revolution Not Filed

The Penoles Mining Co., a subsidiary of the American Metal Co., through its resident manager in this city, Alexander Sauter, has notified the Foreign Office that no claims for revolutionary damages will be presented by his company against the Mexican government. The Kansas City, Mexico and Orient Railway and a number of important foreign concerns have given similar assurance. While damages to these companies have been considerable, the feeling of the members of the Boards appear to be that foreign companies operating in this country should take "pot" luck with the natives.

Greene-Cananea to Explore Democrata Gulch

Greene-Cananea will sink a new 1,500-ft. shaft in Democrata Gulch, to explore ore recently developed by diamond drill holes. It is understood that new bodies of smelting ore were cut below the 1,000-ft. level, in addition to much milling ore found in the same vicinity. About two years will be necessary to sink the shaft, drift over to the ore and block out sufficient ore to commence stoping.

Alleged Mine Salting Cause of Suit

Alleging fraud and conspiracy by salting of mine ores, Charles F. Nourse, of San Francisco, filed suit in the federal court against George De Lion and Mabel De Lion, of Albuquerque, N. M., for $100,000.

The complaint recites that Mr. De Lion represented the Mont de Lion Mining Co. located in Peralta Canyon in the Cochita district of Sandoval County, N. M., as being of great value in rich deposits of gold and silver ores.

De Lion is alleged to have caused samples of ore taken from the mines by Louis F. Haber and his engineers to be salted. The defendants are charged with fraud and conspiracy.

Dunwell Mines Increases Capital

At a special general meeting of the shareholders of Dunwell Mines, held at Victoria recently, it was decided to increase the capital of the company from $700,000 to $1,000,000. Of the new capital, 140,000 shares are to be offered to existing shareholders at 50c. per share, five shares of the existing stock entitling the shareholder to one share of the new stock. The remainder of the new stock will be held in the treasury, and shareholders were assured that if any of it is issued existing shareholders will have the first option of purchasing it. This is the second time that the company has been reorganized. A considerable body of pay ore already has been developed, and indications point to the possibility of increasing the present reserve.

People You Should Know About

George L. Holmes, of San Francisco, has returned from Nome, Alaska, where he examined mining properties.

Theodore Dengler, general manager of the Mohawk Mining Co., Mohawk, Mich., has returned from a visit to the East.

A. Homer Black, mining engineer of Tonopah, Nev., has returned to Tonopah from an extended trip to New York and other Eastern points.

P. Boury, placer mining operator, recently returned from Alaska, where he examined placer properties, to his home in San Francisco.

Paul Lincoln, of Salt Lake City, Utah, has gone to London, B. C., to superintend development of the Noble Five mine, which he has under lease.

Horace Strong, geologist, has been engaged to make an examination of the orebodies at the Peterson Lake mine of Cobalt, in northern Ontario.

Adolph Knopf, of the Geologic Branch of the U. S. Geological Survey, is at Pioche, Nev., to begin his study of the economic geology of the district.

A. N. MacIntosh, geologist, has severed his connection with the Mazapil Copper Co., Ltd., operating in Saetillo, Coahuila, Mexico, and has returned to Canada.

Harlowe Hardinge, vice-president of the Hardinge Company, has just returned from a three months' trip throughout the West and British Columbia.

John Martin has been appointed a director of the Central Mining & Investment Corporation, Johannesburg. It is understood that Mr. Martin will succeed Sir Evelyn Wallers.

H. W. Heslop, of the engineering department of the Broken Hill North Mine, Australia, has been appointed engineer and manager of the Broken Hill Southern Lode Continuation Co.

W. H. Gepp, late general manager of the Electrolytic Zinc Co. of Australia, has been appointed by the Australian Commonwealth Government chairman of a Migration and Development Commission.

Dr. E. R. Weidlein, director of the Mellon Institute of Industrial Research, Pittsburgh, Pa., was in Texas recently, where he examined the mica property of the Micolithic Co., near Callado, east of El Paso.

Dr. W. F. Prouty, professor of economic geology at the University of North Carolina, spent the latter part of the summer in the southern Appalachian region looking up new sources of ornamental building stone.

Dr. L. C. Glenn, of Vanderbilt University, spent two months this summer completing a general reconnaissance of the West Kentucky coal field for a report to be published by the Kentucky Geological Survey.

H. E. Marsh, superintendent at the Mabel mine, of the West End Consolidated Mining Co., 20 miles westerly from Mina, Nev., for the last three years, has resigned and moved to southern California.

A. W. Beam, president and general manager of the Benguet Consolidated Mining Co., Benquet, P. I.; **C. M. Eye**, of San Francisco, and **J. W. Haussermann** are leaving San Francisco on a visit of two months to the company's property.

D. Meredith, for eight years on the managerial staff of the Electrolytic Zinc Co., and formerly general manager of the Amalgamated Zinc (De Bavay's), Ltd., has been promoted to the position of general superintendent of the former company's large works in Tasmania.

Dr. C. A. Heiland

Dr. C. A. Heiland has been engaged by the Colorado School of Mines as professor of geophysics. He will give an advanced course for graduate students and work on research problems. Since coming to the United States, Dr. Heiland has made his headquarters in Houston, Tex., where his company, the Askanie Werke A. G. of Berlin-Friedenau, has opened an office. He will return to Germany to settle his affairs in that country before assuming his professional duties at the Golden School, which will be the first institution in the United States to teach geophysics as applied to mining.

R. C. Canby, consulting metallurgist, sailed from New York on Sept. 29 for Naples. From that city he will go to Spain, sailing from Barcelona on Nov. 14 for Buenos Aires. He expects to return to the United States around the first of the year.

Major General W. Bertram Linsay, of London, England, is visiting the mining districts of Canada in the interest of British investors. He has made an inspection of the mining areas of northern Ontario and is now on his way to British Columbia.

Harold N. Blake, chief mechanical engineer at the Great Falls plant of the Anaconda Copper Mining Co., has been appointed chief engineer of the company's operations at the Giesche's Erben property in Europe. He left for Poland on Oct. 1. He will be succeeded at Great Falls by **Rollin Kennard**, superintendent of the electrical department.

Obituary

Hugh Austin Nearne, chairman and joint managing director of the Dunswart Iron & Steel Co., of the East Rand, in South Africa, died at Johannesburg recently. Mr. Nearne was a native of Kent and spent his early life in the Western States of America, coming to South Africa about thirty years ago, where he lived until his death.

J. C. Murray, mining engineer, died at his home in Tangier, N. S., on Sept. 28, aged fifty-two years. He was well known in northern Ontario and eastern Canada and was formerly editor of the *Canadian Mining Journal*. Mr. Murray was a graduate of Dalhousie and Queens University, Kingston.

John Butler, long identified with the Mesaba Range, died recently. Mr. Butler and his brothers brought the first of the large type of revolving shovels on to the range. Within a few years the large shovels came into general use. Mr. Butler and those associated with him made important contributions to contracting and mining methods.

H. F. E. Pistorius, general manager of E. W. Tarry & Co., Johannesburg, died recently in France, in his eightieth year. The firm started in Kimberley forty-nine years ago, and from that date Mr. Pistorius was associated with the late E. W. Tarry. A branch was opened in Johannesburg in August, 1887, and in 1890 Mr. Pistorius settled permanently on the Rand.

E. W. Griffiths, pioneer Utah mining man, died at his home in Salt Lake on Sept. 30. He was born at Morgan, Utah, on Oct. 10, 1866. Mr. Griffiths early became interested in mining. From assaying, he turned his attention to promotion and aided the financing of mining ventures at Park City, Tintic, and Milford. He was one of the first men to join the rush to Goldfield, Rhyolite, Searchlight, and other Western mining camps.

A. T. Judge died recently at Kuruman, Cape Province, South Africa, where he was engaged on an asbestos prospect. He was born at Kimberley, where his father was Resident Commissioner, and went to Rhodesia on behalf of the De Beers company. He took part in the Matabele campaign and later in the South African war. He was for some time underground manager of the Nourse Mines. Mr. Judge discovered and developed the Amianthus Asbestos Mine in the Barberton district.

F. B. F. Rhodes died recently at his home at Bergerville, Quebec, Canada, aged seventy-three years. Mr. Rhodes, who was a graduate of the Columbia School of Mines, class of '74, was connected with numerous mining and smelting companies during his professional life. For years he was superintendent of the old National plant in South Chicago and later superintendent of the U. S. Zinc smelter in Pueblo, Colo., both under the American Smelting & Refining Co. Mr. Rhodes retired from business in 1911 and since then had resided in Quebec. He is survived by a wife and two daughters.

Societies, Addresses, and Reports

Big Program for Joint Meeting at Spokane and Kimberley

Canadian Institute and American Sections Co-operate—Visits to C. M. & S. Plants Will Be Feature

Programs of the three meetings of mining engineers of the Pacific northwest have been prepared for the middle of this month and will be participated in by prominent engineers and metallurgists of the Northwest and some of the leading men of the nation and Canada. The sessions are expected to be the most important ever held in the Northwest, on either side of the international boundary, for the Canadian Institute of Mining and Metallurgy as a whole is participating and the four northwest sections of the American Institute of Mining and Metallurgical Engineers have united for these meetings. The four northwest sections on the American side are the Columbia (Spokane), North Pacific (Seattle), Montana, and Oregon.

Sessions are to be held two days in Spokane, Oct. 13 and 14; in Cranbrook, B. C., Oct. 15, and at Kimberley, B. C., Oct. 16.

L. K. Armstrong, of Spokane, secretary of the Columbia section, is chairman of the committee on arrangements. George C. Mackenzie, of Montreal, secretary of the Canadian Institute, will assist throughout the program.

Lewis Stockett, president of the Canadian Institute, will respond to the address of welcome on the first day, and in the afternoon he will be in the chair at a technical session and will participate at other sessions.

Philip N. Moore, of St. Louis, former president of the American Institute, will be the special representative of the president, Samuel A. Taylor. He will speak at the first forenoon session, will give an address on "The Engineer's Opportunity," and will preside at the technical meeting the second day.

Perhaps the most valuable portion of the four-day combination meeting will be the inspection of the mines and concentrator of the Consolidated Mining & Smelting Co. of Canada at Kimberley. A large delegation expects to make the trip from Spokane to Kimberley and Cranbrook.

High lights in the four-day program are as follows:

First Day—Welcomes by M. H. Sullivan of Kellogg, Idaho, chairman of the Columbia section, and by E. R. Hannibal, president of the Associated Engineers of Spokane. Responses by Mr. Stockett; Mr. Moore; Charles A. Banks, chairman of the British Columbia section of the C. I. M. & M.; and Henry M. Parks of Portland, Oregon; address by Philip N. Moore; "The Examining Engineer and the Mining Engineer," by J. D. Galloway, provincial mineralogist of British Columbia; "Non-Metallic Mineral Resources of Washington," by Joseph Daniels, of the University of Washington at Seattle, chairman of the North Pacific section of the A.I.M.E.; "Mining in Warfare," by Angus W. Davis, mining engineer, Vancouver, B. C.

Second Day—In the morning W. W. Foster will speak on "Development of the Contract System at the Elm Orlu Mine"; E. H. Parker, efficiency engineer, Elm Orlu Mining Co.; "Geology and Ore Deposits of the Slocan District," C. E. Cairnes, Canadian Geological Survey; "Stratification: Theory and Application in Ore Dressing," A. W. Fahrenwald, ore dressing engineer; "Electrical Prospecting at the Britannia Mine," James I. Moore, superintendent, and Frank Ebbutt, geologist at that property; "The Junior Member," George C. Mackenzie, secretary of the Canadian Institute.

Third Day—Leave Spokane at 7:50 by train or auto for Cranbrook, B. C., breakfast and lunch on train. At 6:30 p.m. dinner by Cranbrook Board of Trade; 8:30, paper on "Mining Methods at the Sullivan Mine," by members of the staff of the Consolidated Mining & Smelting Co.

Fourth Day—At 9 a.m., motor to Kimberley, and underground inspection of the Sullivan mine; luncheon with the Consolidated Mining & Smelting Co.; 2 p.m., visit to the concentrator followed by motor trips; 7 p.m., banquet at Kimberley. The next day, Sunday, many will visit the smelters, refineries, and power plant at Trail, B. C., and Bonnington Falls.

A.S.M.E. Names C. M. Schwab, Honorary Member, as President

The American Society of Mechanical Engineers has elected Charles M. Schwab president of the society for the coming year. Mr. Schwab is already well known to the 18,000 members of the national engineering organization, having been elected an honorary member in 1918 as a recognition of his great part in the upbuilding of the steel industry and his ability as an industrialist and organizer.

Mr. Schwab will formally assume his new office as A.S.M.E. president at the annual meeting of the society in New York early in December, at which time he will succeed William L. Abbott, of Chicago. Mr. Schwab has accepted the responsibility with his characteristic enthusiasm, and it is certain that his organizing power and engaging personality will go far toward promoting the cause of organized engineering effort in the United States.

Other new officers include vice-presidents, Messrs. Charles L. Newcomb, Everett O. Eastwood, and Edwards R. Fish. Mr. Newcomb is manager of the Deane works of the Worthington Pump & Machinery Corporation, at Holyoke, Mass. He is a veteran member of the A.S.M.E., having joined in 1883, three years after it was founded. Everett O. Eastwood is professor of mechanical engineering at the University of Washington, Seattle, Wash. Edwards R. Fish is vice-president of the Heine Boiler Co., St. Louis, Mo., having been with that company since 1893.

The three new members of Council are Colonel Paul Doty, of St. Paul; Ralph E. Flanders, of Springfield, Vt., and Conrad N. Lauer, of Philadelphia.

Fiftieth Annual Safety Congress at Detroit Oct. 25-29

Varied and Interesting Program Will Feature Miners' Problems

Detroit will be the scene of the Fiftieth Annual Congress of the National Safety Council Oct. 25 to 29. Three sessions of the Mining Section will be held under the chairmanship of B. C. Yates, superintendent of the Homestake Mining Co. of Lead, S. D. Among the papers of special interest to the metal mining industry are:

"Safe Methods in Blasting Operations in the Lake Superior District Mines, Underground and Open Pit"—C. S. Hurter, technical department, E. I. du Pont de Nemours & Co., Duluth, Minn.

"Methods of Promoting Safety Interest in the Homestake Mine"—A. J. M. Ross, general mine foreman, Homestake Mining Co., Lead, S. D..

"Phelps Dodge Corporation Employees' Representation Plan and Its Connection With Safety and Personal Relations"—H. C. Henrie, employment manager, Copper Queen Branch, Phelps Dodge Corporation, Bisbee, Ariz.

"Value of Rock Dusting as a Safety Measure in Preventing Coal Mine Explosions"—J. S. Jones, safety engineer, Old Ben Corporation, West Frankfort, Ill.

"Safeguarding Electrical Equipment in Mines"—Daniel Harrington, chief engineer, Safety Service Bureau of Mines, Washington, D. C.

"General Safety in and about the Mines"—Clyde McDowell, manager department of industrial relations, Davis Coal and Coke Co., Thomas, West, Va.

C. M. & M. Society at Johannesburg

The August meeting of the Chemical, Metallurgical and Mining Society of South Africa was held in the Scientific and Technical Club, Johannesburg, on Aug. 21. The new president, H. R. Adam, gave his inaugural address, dealing with research work on amalgamation, capillary attraction, and oil flotation. Robert Kotze, government mining engineer, read a paper on "Explosive Accidents in Mines," being the opening of a symposium on this subject. Various papers came up for discussion and there was a good attendance of members. A smoking concert was held on Aug. 28, when a film, "The Story of Sulphur," was exhibited.

A.E.C. Board Will Meet at Ithaca Nov. 11 and 12

The administrative board of the American Engineering Council will meet at Ithaca, N. Y., Nov. 11 and 12. Reports will be received from numerous committees which have been active during the summer. Among the topics in the large agenda which is being prepared are safety and production, registration of engineers, government reorganization, and jurisdictional strikes in the building industry. Dean Dexter S. Kimball of Cornell University, the president of the council, will preside.

Recent Technical Publications

Reviews, Abstracts, and References

American Ore-Dressing Practice

A Text Book of Ore Dressing. Second edition, completely revised and rewritten. By Robert H. Richards and Charles E. Locke, assisted by John L. Bray. McGraw-Hill Book Co., New York. Price $5.50.

The new edition of this book has now been published for some time, and its importance warrants a more prompt review, for it is easily the most complete and up-to-date work on American ore-dressing practice available. Dr. Richards' original work, "Ore Dressing," appeared in two volumes in 1903; this was revised by the issuance of two additional supplementary volumes in 1909, and soon after that date the first edition of "A Text Book of Ore Dressing" appeared, designed to condense the large amount of material in the four volumes into a form suitable for classroom use. The present work is a revision of the single volume that appeared sixteen years ago, and it may therefore readily be imagined that much rewriting and the addition of entirely new material were necessary. In this, Dr. Richards has depended to a large extent on the junior authors.

In its 570 pages, the following subjects are taken up in succession: breaking, crushing, and grinding, principles and machinery, 94 pages; washing, screening, and classifying, 75 pages; jig, table, and miscellaneous concentration processes, 92 pages; flotation, 46 pages; accessory apparatus, mill principles and processes, and general considerations, 146 pages; and coal dressing, 80 pages. The last 40 pages are taken up with tables and index.

The authors have done an excellent job and have produced a book that is up to date so far as a book of this nature can be, and which is an essential addition to the library of any mining engineer as well as being a comprehensive textbook for students. The contents have been well selected for the primary purpose of the authors in meeting the demand for a book for students' use; it will, of course, be supplemented by lectures and notes from the instructor.

In a book of this size, and especially in a revision of an earlier work, it is easy to pick out here and there statements and methods of treatment of certain subjects with which the reviewer cannot wholly agree: the authors could take their own work and do the same. However, possibly a few comments will not be amiss.

"A typical ore dressing process" is said to consist of "coarse crushing, jigging, fine crushing, hydraulic classification, tabling, further grinding, and treatment in oil flotation machines." This is well representative of modern practice, though we should be inclined to omit jigging as being more unusual than typical. Hydraulic classification is not the complicated matter it used to be, for usually a form of rake classifier in closed circuit with a grinding mill is the only example of this particular phase of ore dressing seen in a mill. Perhaps a little too much space is given to the principles of classifying and settling, though, of course, the student should be taught the fundamental principles involved.

Reduction of particle size is usually considered under the heads of breaking, crushing, and grinding, or merely crushing and grinding. The authors seem to have an aversion to the last-mentioned term, however, for they state that "the word 'breakers' should be used for all machines breaking to relatively large sizes, while we may designate as 'crushers' all the other varied machines which may be employed to comminute the ore further . . . such as rolls . . . ball mills, pulverizers, etc." It would seem advisable to classify what happens in ball, rod, and tube mills, as grinding. Stamps are given more space than ball or rod mills, though now of much less importance, and the same might be said of the relative space given to jigs and tables. The treatment of rod mills, particularly, might have been elaborated on a little. A curious error is made on page 69 wherein the Marcy mill is described as a ball mill "which has a special peripheral discharge grating," whereas this is, of course, an end-discharge mill.

There is a good chapter on screens and screen sizing, in which some of the newer forms of machines, of which there are now so many, are described. The sections on classification and jigging are certainly as complete as could be desired, reflecting the particular interest of the senior author in these subjects. The Akins classifier should be spelled Akins and not Aikens.

Flotation practice advances so fast that the latest advances cannot be put into a book, but the chapter on that subject will give a good fundamental knowledge of the methods and machines used, even if it leaves something to be desired on the subject of differential and selective work. The discussion devoted to flotation testing should be especially useful to the young or inexperienced engineer.

A good assortment of mill flow sheets and explanations of practice may be found toward the end of the book. The chapter on coal dressing will not be of as much interest to the metal miner as the first part of the book will to the coal operator.

The practice of the authors in making a blanket acknowledgment of credit to others is not to be commended. In the preface they say "Use has been made of existing books on Ore Dressing by other authors and acknowledgment is hereby made of our obligation to the authors of these books." No specific textual or footnote references are given, nor is any list of sources of information appended. This is not adequate credit. A glaring example of this is the use of 7½ pages of smelter settlement calculations and text taken, with some inconsequential changes in wording, in toto from an article by Arthur B. Parsons on the Marketing of Metalliferous Ores and Minerals, first published in *Engineering and Mining Journal-Press* in December, 1922.

E. H. ROBIE.

The Mineral Industry. Its Statistics, Technology, and Trade During 1925. Edited by G. A. Roush and Allison Butts. McGraw-Hill Book Co., Inc., New York City. Price $12.

This valuable book appears fifteen days earlier this year than last, and of course is months and even years ahead of the Bureau of Mines' "Mineral Resources" volumes, covering to some extent the same field. The 1925 volume is similar to the others of the series, and is an authoritative compilation of the data that have been published during the year on the various important metals and non-metallic minerals, enriched by personal contributions from the specialists who have been responsible for the various chapters. All the principal technical articles that have appeared in the period under review are abstracted, and there is the usual report of progress made in ore dressing and coal washing. A valuable reference book for the library of any mining engineer.

Mineral Resources — A preliminary summary of "Mineral Resources of the United States in 1925," by Frank J. Katz and Martha B. Clark, pp. 120, has recently been published by the U. S. Bureau of Mines, and may be obtained for 20c. from the Superintendent of Documents, Washington, D. C. "Cement in 1924," pp. 36, by E. F. Burchard and B. W. Bagley, was also published recently, and may be obtained from the address given, for 5c.

Molybdenum—What is possibly the most comprehensive bulletin so far issued on the occurrence, mining, and concentration of molybdenum ores, together with the metallurgy and uses of the metal, has recently been published by the Canadian Department of Mines, Ottawa. The book is of 292 pages, of which 138 pages is devoted to a detailed description of Canadian occurrences; the remainder is of general interest, taking up the history of molybdenum, prices, uses, and properties; ores of molybdenum, general occurrences; costs, analyses, and concentration; and the use of molybdenum in alloy steels and other purposes. Maps showing molybdenite occurrences in the various Canadian provinces are appended. The author is V. L. Eardley-Wilmot. Bulletin 592, as this is called, may be obtained from the Mines Branch, Department of Mines, Ottawa, Ont., presumably on request.

Canadian Mining—Recently published Canadian Government bulletins include: "Geology and Economic Possibilities of Sutton Lake Area, District of Patricia," pp. 56, by J. E. Hawley, obtainable on request from the Ontario Department of Mines, Toronto; "Annual Report on the Mineral Production of Canada During 1924," pp. 224, giving names and addresses of all operating mines, obtainable for 50c. from the Dominion Bureau of Statistics, Ottawa, Ont.; "Mineral Production of Ontario, 1st January to 30th June, 1926," pp. 8, by W. R. Rogers and A. C. Young, Bulletin No. 57, obtainable on request from the Department of Mines, Toronto, Ont.; and "Report on Mining Operations in the Province of Quebec During the Year 1925," pp. 197, obtainable on request from the Bureau of Mines, Quebec, Canada.

New Machinery and Inventions

An Improved Flow Meter

Operates on Simple Inductance Bridge Principle and Is Free from Electrical and Mechanical Difficulties

A new electrically-operated flow meter has been developed by The Brown Instrument Co., Philadelphia, Pa., that by a novel but thoroughly practical utilization of a well-known electrical principle in its design is said to avoid all electrical as well as mechanical difficulties previously met in flow meters.

Among the characteristics of this new line of instruments are the following notable features:

1. The readings of the instrument are fundamentally independent of the value of the voltage impressed upon the electrical system. The instrument reads correctly, while operating on varying line voltages without the use of either voltage regulators or compensators.

2. The electrical circuits at the manometer, indicator and recorder consist simply of stationary, divided inductance coils. These have only three connections which are permanently made at the time of installation. There are no make-and-break contacts, such as contacts dipping into mercury within the pressure chamber, voltage regulator contacts or similar devices.

3. In the manometer, or meter body, all electrical windings and connections are entirely external to the pressure chamber.

4. The integrator is a mechanical device operated by the electric clock which drives the charts. An equal amount of power is available for operating the integrator at all rates of flow, making possible the use of the most easily-read type of five-figure counter for the integrator.

5. A pen operated by the action of the integrator mechanism makes a record at the outer edge of the chart each time the integrator mechanism increases the counter reading by one unit. Each tenth mark is distinguishable from the intermediate marks in order to facilitate counting when it is desirable to determine the total flow for a day, or during any hours of the day, without having to watch the counter.

6. The entire integrator mechanism with its individual recording pen is so simple and compact that it can be mounted in the standard recorder case along with the recording mechanism, thus avoiding the necessity of a separate integrator case.

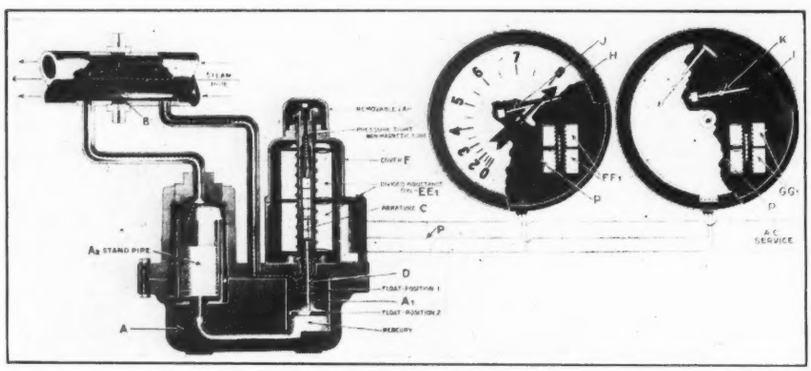


Fig. 1. Diagram showing construction of new electric flow meter

How the Flow Meter Operates

As shown in Fig. 1, manometer *A* operates in response to differential pressure caused by the fluid through an orifice *B*. When the rate of flow increases, mercury is depressed in chamber A_1 and rises in chamber A_2, the difference in mercury level in the two chambers being a measure of the rate of fluid flow through the orifice in accordance with well-known principles. When the flow increases from zero to a maximum value, a float which rides on the mercury surface in chamber A_1 is lowered from the position indicated by dotted lines to a lower position as indicated by the solid lines. The float is made of non-corrosive metal and chamber A_1 has a molded bakelite lining, ribbed on the inside, insuring freedom of action at all times. An armature *C* of transformer iron is supported by the float on a non-magnetic rod *D* and the armature is raised and lowered in accordance with the motion of the float.

This armature travels inside of a rust-proof, non-magnetic tube which has high electrical resistance and great mechanical strength. The pressure of the fluid being metered is confined within this tube and the electrical inductive winding EE_1 which is slipped over the outside of the tube has excellent magnetic linkage with the armature which moves inside. At the same time, the coil is under atmospheric conditions only and is protected by a cover *F*.

The outer ends of the divided winding EE_1 are connected directly across the service mains of an alternating-current supply line and connections are run from these ends directly to the outer ends of a similar divided inductance coil FF_1 which operates an indicator *H* and also to divided inductance coil *GG*, operating a recording instrument *I*. Armatures are hung on counterbalanced arms *J* and *K* in the two instruments. The points of connection between the two parts of divided coils EE_1, FF_1, and GG_1 are all connected together by a neutral wire *P* and when thus connected the coils form the self-adjusting inductance bridge which is the outstanding basic feature of this flow meter.

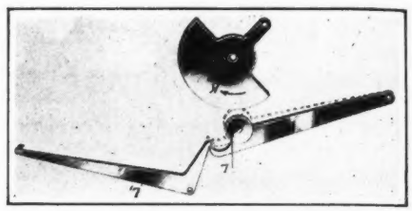


Fig. 2. Counter-operating mechanism for flow meter

When the armature in the manometer is raised or lowered by a change in fluid flow, the relation between the voltages across the two parts *E* and E_1 of the winding will be changed. This causes the currents in the two parts FF_1 of the indicator coil, and also the currents in the two parts GG_1 of the recorder coil, to become unequal; as a result the armatures of the indicator and recorder move to new positions corresponding to the position of the armature *C* and the meter readings are adjusted accordingly by means of the gearing or linkage shown.

More briefly, the operation of the inductance bridge may be summarized by saying that the armatures of the instruments move in accordance with the motion of the manometer armature as the latter is moved up and down by the mercury float. Since the positions assumed are such that the relative voltages across the two parts of each coil are the same, the operation of the instrument is independent of the actual value of the line voltage. No current flows in the neutral wire and the currents in the two halves of each divided coil are equal except when the armatures are being moved.

The Integrator

In order to make use of the simple inductance bridge method of operation, a special type of integrator was developed which increases the counter readings in proportion to the square root of the angular deflection of the recorder pen arm, this being the relation of flow to the pressure difference across the orifice. Attached to the gear train which drives the recorder chart is a

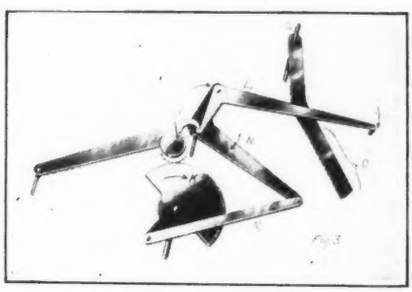


Fig. 3. Mechanism reproducing square-root law in flow meter

sector of a disc K (Fig. 2) which rotates at a constant rate. A roller L is normally held up by latch L_1, out of contact with the sector. The latch is tripped when the sector is in different positions, depending upon the rate of flow, and the roller is rotated through an angle proportional to the rate of flow before the sector passes out of contact with it. After the sector passes beyond the roller the latter is again latched up by L_1 and the process repeated at regular intervals.

The square root relation existing between rate of flow and pressure difference (the latter being translated into recorder pen travel) is reproduced in the relation between angular travel of disc L and pen deflection by means of the oscillating latch carrier N being driven by the rotating sector K, through a link N_1 shown in Fig. 3.

Tripping blade O which is attached to the recording pen shaft O_1 releases the latch at the proper point, according to the reading of the instrument, the motion of the pen never being restricted by the tripping operation.

The angular relation between the uniform rotation of sector K and the rocking motion of arm N is almost exact reproduction of the square root law through a large portion of the downward motion of arm N and a slight departure from the exact relation desired is taken care of by the shape of tripping blade O. A roller on the end of arm N passes across tripping blade O, which is very thin, and holds O fast against a plate while latch L_1 is being tripped.

Two important features of this design are: First, the parts are simple and can be made accurately under practical manufacturing conditions so that the square root relation is always reproduced correctly by the mechanism; and, second, such a simple integrating mechanism which reproduces the square root relation permits the employment of the inductance bridge method of transmitting the meter readings.

When roller L has turned through a definite number of revolutions a pawl is released which thereupon engages with a toothed pinion of the chart-driving gear train. This causes a cam Q, Fig. 4, to make one complete revolution after the pawl is released and the cam then remains at rest until the roller again completes the proper number of revolutions.

As the cam Q advances, a cam arm R is gradually raised, lifting the arm of ratchet counter S until the high point Q_1 of the cam passes, then the cam arm falls quickly and advances the reading of the counter by one unit without allowing the figures to pause in a half-way position difficult to read.

Each time the cam arm falls the recording planimeter pen T makes a jog U in its record line, every tenth jog U_1 being in the opposite direction to facilitate counting when desired. The five-figure integrator dial S can be read at any given hour or hours of the day, and records made on the chart or elsewhere if desired; but the record of the recording planimeter can take the place of these counter readings and affords the added advantage of making a record from which the total flow can be read off for any desired fraction of a day at any subsequent time which may be convenient—eliminating the necessity of having an observer on hand at the proper hours to note the readings of the counter as they occur.

A series of printed charts is chosen with a fixed ratio between successive ranges. The manometers also are arranged to be adjusted for several appropriate ranges. This simplifies the choice of an orifice plate, the size of which demands chiefly upon the density of the fluid and the pipe size. With such an orifice the apparatus is easily adjusted for successive chart ranges by using a stand-pipe of proper size in the manometer. This is useful where the average load changes from time to time, for then the apparatus can be readjusted by changing the manometer stand-pipe—instead of changing the orifice plate, which is much less convenient.

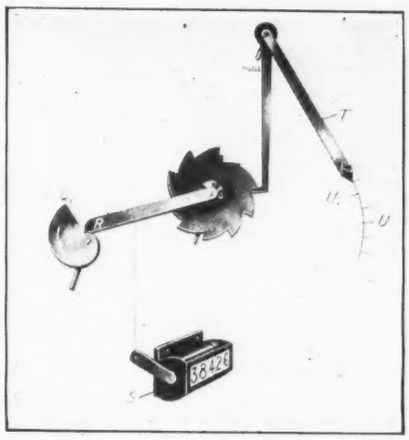


Fig. 4. Counter and recording planimeter for flow meter

The various manometers for use with steam operate on successive maximum pressure differentials increasing by intervals of about 60 per cent, ranging from 1.6 in. to 16 in. of mercury. There are six ranges in this series, the choice of a suitable manometer depending upon velocities encountered. Any manometer of the series, however, may be converted into the most sensitive one by simply opening a valve. This adapts the meter for use with one of the lower range charts, making it easily convertible for low load periods, which will be a distinct advantage in many types of service.

Where the apparatus must work on very low pressure differentials an especially sensitive type of manometer is provided, the most sensitive of which gives full deflection of the meter on a pressure difference of ½ in. of water, although the operating force of the meter mechanisms of this high-sensitivity series is as great as that of the high-range manometers.

New Oil Circuit Breakers

A new line of General Electric oil-circuit breakers is designed for either indoor or outdoor service on systems of relatively large capacity. These are available in sizes of 400, 600, 800 and 1,200 amp. and voltages of from 15,000 to 88,000 inclusive. They bear the General Electric designations FK-236 and FHK-236. Those rated at 73 kilovolts or less may be used up to altitudes of 10,000 ft. The 88-kilovolt breakers are equipped with "high altitude" bushings when used above 4,000 ft. The range of interrupting capacities for the FK-236 breakers is from 2,000 to 7,000 amp., and from 3,300 to 14,000 amp. for the FHK-236 type.

Each triple-pole breaker is made up of three single-pole, single-throw units operated by a single mechanism. This mechanism may be manually operated or electrically operated by either a solenoid or a motor.

Unit mechanisms are totaly enclosed within the breaker frame and are, therefore, freed of any tendency to reclose under the action of unbalanced internal pressures which may be set up when opening under abnormal conditions. A larger air space is thus also provided with consequent increases of interrupting capacity.

Of the two forms, the type FK-236 uses finger and blade contacts, while the type FHK-236 is equipped with plunger or rod type contacts and explosion chambers. With explosion chambers, higher interrupting capacities are obtained.

New Chrome Cement Offered

The General Refractories Co., of Philadelphia, manufacturers of fire clay, silica, magnesia, chrome, and high alumina refractories, has announced through its new folder a distinctively different refractories cement, called Grefco. The fact that this cement is composed of a chrome ore base is not new to the trade, but its freedom from sodium silicate and other low fusing binders makes it entirely different from any other chrome base cement.

Because of the fact that this cement is of a neutral character it is of much practical use in the metallurgical industry because of its resistance to acid, as well as to basic slags. As a mortar and protective coat for boiler settings and similar furnaces where coal ash slags are formed it is especially desirable, and in ceramic kilns it has demonstrated without question its ability to protect the brickwork from the erosion of the gases, as well as the slagging or surface fusion of firebrick work in the fire boxes or bag-walls, which is always present in unprotected firebrick work.

This company will gladly have their representative call on any interested parties, and will send a sample of this material upon request to their office, 117 South 16th Street, Philadelphia.

Centrifugal Pumping. Goulds Pumps, Inc., Seneca Falls, N. Y., has issued in pamphlet form a report by Robert L. Daugherty entitled "A Further Investigation of the Performance of Centrifugal Pumps When Pumping Oils." It is Bulletin 130.

Survey Maps—W. & L. E. Gurley, Troy, N. Y., makers of engineering instruments, have issued a book entitled "U. S. Maps and Charts" in which is explained the organization and activities of the Board of Surveys and Maps of the Federal Government. It tells how the maps and charts of the U. S. Government are made and where they are obtainable.

The Market Report

Copper and Zinc Sales in Better Volume

Prices of Practically All Non-Ferrous Metals Weaken, However, and Market Shows Little Snap

New York, Oct. 6, 1926—The volume of business done by copper and zinc sellers has registered an improvement in the week ending today, but has not been nearly equal to that done in some of the busy weeks of September. Sales have been largely the result of active efforts to tempt consumers at concessions in price. Lead has sold in only fair tonnage, and there, too, prices have weakened. Prompt tin is virtually a nominal market, prices holding well on account of the excessive scarcity, but showing few signs of further inflation. Silver showed a little strength for a day or two, but sharply declined yesterday and today to a new low level, at 56¼c. London prices have also declined on all of the metals quoted.

Though domestic consumption continues excellent, and foreign demand shows signs of improving rather than otherwise, metal prices have recently shown a pronounced tendency downward. This has been true also of many other commodities, notably cotton. Some fear that the present degree of prosperity will not continue far into 1927 is evidenced by the weakness in the stock market in the last few days. Fortunately, practically all consumers of metal are operating with extremely modest stocks of raw material, so that no long-continued inactivity in the metal markets, or sharp drops in prices need be expected, especially in the case of copper, zinc, and lead. It is yet too early to say whether the current weakness is the beginning of a major decline in metal prices, or only a temporary condition.

Concessions in Copper Prices

Copper has sold in somewhat better volume than last week, but only because sellers have actively canvassed the market, and almost without exception have offered concessions in price from the level at which they were nominally holding. Until today noon, no actual sales had been reported under 14.20c., delivered Connecticut, and 14.30c. in the Middle West, though 14⅛c. was done on a fair tonnage in Connecticut this afternoon, and 14.20c. at higher freight rate shipping points. There has been a little more tendency than before to buy for December shipment; in fact, January shipment has

Average Metal Prices for September, 1926

Copper:	
New York Electrolytic	14.062
London Standard Spot	58.705
London Electrolytic Spot	66.528
Lead:	
New York	8.786
St. Louis	8.515
London Spot	32.085
London Forward	31.790
Silver:	
New York	60.580
London	27.904
Sterling exchange	484.845
Zinc:	
St. Louis	7.413
London Spot	34.389
London Forward	34.415
Tin:	
99 per cent	66.535
Straits	68.895
London	306.273
Quicksilver	91.425
Antimony	15.325
Platinum:	
Refined	116.840
Crude	108.600
Aluminum, 98 per cent	27.000

Daily Prices of Metals

Sept. Oct.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
30	14 00	67 00	69 50	8 725	8.375@8.40	7 35
1	14 00	68 50	71 00	8 65	8.35@8.375	7.325–7.375
2	14 00	68 50	71 00	8 65	8.35	7.325–7.375
4	14 00	69 00	71.625	8 65	8.35	7.325@7 35
5	14.00	69 00	71 25	8.60@8.65	8.325@8.35	7.325@7 35
6	13 90	69.50	71.75	8 50	8.30	7.30@7.35
Av.	13 983	68 583	71 021	8 633	8.348	7.342

The prices correspond to the following quotations for copper delivered: Sept. 30th, Oct. 1st, 2nd, 4th and 5th, 14.25c.; 6th, 14.15c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Sept. Oct.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
30	58 1/4	59	66 1/4	308 3/4	299 1/4	31 9/16	31 3/8	34 13/16	34 1/2
1	58 1/4	59	66 1/4	315 1/2	303 3/4	31 7/16	31 1/4	34 9/16	34 7/16
4	58 3/8	59 1/8	66 1/4	317 1/2	306	31 3/4	31 1/4	34 9/16	34 7/16
5	58 1/8	58 7/8	66	317 1/4	305	31 1/4	31 1/16	34 5/8	34 7/16
6	57 3/4	58 1/2	66	318	306 3/4	31 1/16	30 7/8	34 3/8	34 3/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Sept. Oct.	Sterling Exchange "Checks"	Silver		Gold London	Oct.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
30	4 84 5/8	56 7/8	26 1/8	84s11 1/2d	4	4 84 5/8	58 3/8	26 3/4	84s11 1/2d
1	4 84 5/8	57 1/8	26 5/16	84s 9 3/4d	5	4 84 5/8	56 7/8	26 5/16	84s11 1/8d
2	4 84 3/4	57 7/8	26 11/16	..	6	4 84 5/8	56 1/4	25 13/16	84s11 1/2d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

been specified in some instances. The same price has obtained, regardless of time of delivery. It will be noted that there is a contango in London copper prices, though a backwardation in tin, lead, and zinc. Apparently London dealers feel that the announcement of the formation of the Copper Export Association, and its functioning, now expected very shortly, may give a little strength to the market.

Lead Back to 8.50c.

The American Smelting & Refining Co. made two cuts in its official price for New York lead during the week ending today. On Friday, Oct. 1, a reduction of $2 per ton brought the price from 8.75c. per lb. to 8.65c., and today, Oct. 6, a further cut of $3 per ton made the price 8.50c. The feature of the market is the almost entire absence of business for forward delivery. Most of the purchases specify prompt delivery, with a modest amount for second half of October. The volume of transactions has been moderate, with purchases well distributed among manufacturers in each of the important lines. However, it is evident that they hope for further declines from the current prices. The curve representing the price of lead tends to fluctuate in broad waves, and buyers are willing to speculate on the probability that with the price started downward, as has happened in the last few weeks, the decline will continue. The weakness is as usual attributable in a measure to the persistent decline in the London market. At current levels it is advantageous to sell foreign-produced bullion lead in the domestic market rather than abroad. As a matter of fact, in the present state of the market, there is sufficient domestic lead to meet requirements. This does not mean that the producers have excessively large stocks on hand, but they are carrying the stocks rather than the immediate consumers.

Before the Smelting company cut its price today, dealers and second-hands, as well as some of the producers, were willing to shade the "Trust" figure. In St. Louis, 8.35c. has been the prevailing figure all week until today, though sales at 8.375c. and 8.325c. have been noted. The leading interest in the West has been content to follow rather than support the market.

Antimonial lead has been in good demand, and several good-sized sales have been made during the week at close to the price for common. The premium on corroding grades continues at from $2 to $3 per ton.

Zinc Slightly Easier

For three months zinc has varied between 7.30 and 7.50c., with a brief spurt to 7.60c., and it has shown remarkable stability between these levels. In common with other metals, prices have been gradually receding in zinc during the last two or three weeks, until it is now about 7.325c.—close to the lower end of the above range. So far, there seems no immediate likelihood of its getting much lower, as ore prices would not permit smelters to sell below 7.30c., and ore producers are not disposed to accept less than $49—some not even that. Zinc has sold in better volume than last week, largely for November shipment, but galvanizers report some let-up in their orders, and are not disposed to contract for any important tonnages with the current state of the market. High-grade continues to be available at 9c. per lb. in the Middle West and 9¼c. in the East. New York prices on Prime Western are at the customary freight differential of 35c. per 100 lb. above St. Louis.

Spot Tin Scarce

Practically no spot Straits tin is to be had, and the market is largely nominal. Metal on the "President Hayes," which should arrive about Oct. 12, is selling today at 71.75c. per lb. The domestic market became a little stronger each day during the week ending today, yesterday excepted, in step with London. Metal of 99 per cent grade has become a little tighter, though the spread between that and Straits is still wide. Preliminary estimates indicate that American deliveries will be a little over 6,000 tons for the month and that a decline in the world's visible supply will be shown. Late October delivery is about 1c. under prompt, November 2¼c., and December 3c. Buying by consumers is not active, but some has been reported each day.

Francs Up, Lire Down

Some fluctuation in foreign exchanges took place during the week ending today, making a net improvement of 0.02¼c. in francs and a net decline of 0.0425c. in lire. Closing cable quotations for the leading foreign exchanges on Tuesday, Oct. 5, were as follows: francs, 2.83¼c.; lire, 3.77c.; marks, 23.82c.; Canadian dollars $\frac{1}{16}$ per cent premium.

Silver Lower and Steady

On Sept. 30 the London and New York silver markets touched the low points for the year up to that date, but at the lower level buying orders from India, together with some support from China, advanced prices. This rally reached its peak on Oct. 4, with quotations of 26⅜d. in London and 58⅜c. in New York; but on renewed heavy sales by China, rates broke again on Oct. 5, and the decline continued to Oct. 6, when new lows for the year were established at 25$\frac{13}{16}$d. in London and 56¼c. in New York. The market appears steady at the close.

Mexican Dollars (Old Mexican pesos): Sept. 30th, 43¼c.; Oct. 1st, 43⅜c.; 2d, 44c.; 4th, 44¼c.; 5th, 43¼c.; 6th, 42⅜c.

Steel Firm—Pig Iron and Coke Strong

Pittsburgh, Oct. 5, 1926

Production of steel in September was at approximately the same rate as in August, when the steel industry ran at 86 per cent, against 78 per cent in July. Production of ingots to Oct. 1 was approximately 11 per cent above that in the same period last year.

With orders for about 4,600 freight cars reported in two weeks, and inquiries expected soon for 13,000 cars, there is a mild revival in that direction after six months of almost complete stagnation.

Steel prices are very steady all along the line and in a few spots there is stiffening, though no general advance is predicted. Advances of $2 a ton in blue annealed, black and galvanized sheets were recently announced by mills, and the higher prices, 2.40c. for blue annealed, 10 gage, 3.10c. for black, 24 gage, and 3.95c. for galvanized, 24 gage, are now the market, but buyers are covered on by far the major portion of fourth-quarter requirements at old prices. Merchant bars are more frequently bringing 2.10c. in small lots.

Pig Iron—The 50c. advance in bessemer iron in the Valley market has been followed by a similar advance in foundry iron. Low sellers simply withdrew, there being little increase in demand. Bessemer, $18.50@$19; basic, $17.50; foundry and malleable, $18@$18.50, f.o.b. Valley furnaces.

Connellsville Coke—There is little demand, but quotations are strong, due to demand for coal at prices more profitable than coke at recent figures. Spot furnace coke remains at $3.40@$3.60, while spot foundry is up 25c. in sympathy, at $4.25@$4.75.

Unchanged Prices for Lead Ore and Zinc Blende

Joplin, Mo., Oct. 2, 1926

Zinc Blende	Per Ton
High	$54.00
Premium blende, basis 60 per cent zinc	$50.00@51.00
Prime Western, basis 60 per cent zinc	49.00
Fines and slimes, 60 per cent zinc	48.00@45.00
Average settling price, all zinc	49.11
Galena	
High	$114.25
Basis 80 per cent lead	110.00
Average settling price, all lead	111.67

Shipments for the week: Blende, 12,151; calamine, 63; lead, 1,951 tons. Value, all ores the week, $816,620.

No offerings over $49 basis Prime Western were reported, and sellers were withholding ore from the market at a late hour this afternoon. Sales have been unusually light for several weeks, and eight days' rain has prevented the loading of ore already purchased. The shipment is the smallest since July 10, and is less than the tonnage purchased last week for this week's delivery. This week's purchase was 10,860 tons zinc.

Sales of lead have materially fallen away, lowering the shipment of lead concentrates below the average.

Rain has caused a decrease in production of both zinc and lead, there having been more than twelve inches since it began raining in August.

Platteville, Wis., Oct. 2, 1926

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$51.75
Lead Ore	
Lead, basis 60 per cent lead	$110.00

Shipments for the week: Blende, 1,141 tons; lead, 80 tons. Shipments for the year: Blende, 41,773; lead, 1,566 tons. Shipments for the week to separating plants, 2,246 tons blende.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified. London prices are according to latest mail advices.

Aluminum—Per lb., 99 per cent, 27@28c.; 98 per cent, 27c. London, 98 per cent, £107 per long ton. Break from £118.

Antimony—Per lb., duty paid: Chinese brands, 14@13¾c.; November, 13½c.; December, 13.375c. Chinese offerings limited but domestic demand is dull. Cookson's "C" grade, spot 17¾@18c.

Chinese needle, lump, 12c. Standard powdered needle, 200 mesh, 13@14c. White oxide, Chinese, 99 per cent Sb_2O_3, 16c. Nominal.

Bismuth—Per lb., in ton lots, $2.70@$2.75. London, 10s.

Cadmium—Per lb., 60c. London, 1s. 10½d.@1s. 11d. for American metal; 1s. 9d. for Australian metal.

Cobalt—F.o.b. Canadian works, per lb., shot, 96@98 per cent, $2.50. Black oxide, 70 per cent, $2.10. London, 10s. for metal; 8s. for black oxide; 8s. 10d. for gray.

[1]**Germanium Oxide**—Per gm. in 25 to 50 gm. lots, $6.

Iridium—Per oz., $125@$135 for 98@99 per cent. London, £63@£65 in iridio-platinum; £50@£55 for sponge and powder.

[1]**Lithium**—Per lb., 95@96 per cent grade in 1 to 5 lb. lots, $65.

Magnesium—Per lb., in ton lots, ingot, 75@80c. depending on quality; best 99.8 per cent. Market firm. Increasing demand in aeroplane industry. London, 3s. 9d.@4s. 3d. for 99 per cent ingots or sticks.

[1]**Molybdenum**—Per kg., 99 per cent, $25; C. P. metal, $80.

Monel Metal—Base price for shot, 32c. per pound.

Nickel — Per lb., ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade). London, £170@£175 per long ton according to quantity.

Osmium—Per oz., $60@$70; London, £17@£20.

Palladium — Per oz., $68@$70. As a constituent of crude platinum, $55@$60 per oz. London, £12@£15, nominal.

Platinum — Official price on refined metal $115 per oz. Sept. 30 to Oct. 3; $112, Oct. 4, 5 and 6. Open market cash sales of large lots at $107. Pure metal as a constituent of crude platinum, $106. Several large lots of re-sale metal have hurt the market. Recession believed to be temporary by dealers.

London, £23½ per oz. for refined, and £21@£22 for crude and scrap.

Quicksilver—Per 75-lb. flask, $94@$95. London, £15⅜. San Francisco wires $93.

Radium—$70 per mg. radium content.

Rhodium—Per oz., $65@$75; London, £14@£17. Nominal.

Ruthenium—Per oz., $55@$65, nominal. London, £12@£15.

[1]**Selenium** — Black, powdered, amorphous, 99.5 per cent pure, $2 per lb. in ton lots. London reports good demand at 7s. 6d.

Tantalum — Per lb., $36. Nominal only, as only seller has none to offer in open market.

Tellurium—Per lb., $2.

[1]Price furnished by Foote Mineral Co., Philadelphia.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $10 per lb. in 25-lb. lots.

Tungsten Powder—Per lb., 97 to 98 per cent pure, $1.05.

[1]**Zirconium Metal**—Per lb., 98 per cent grade, $30 in 5 to 10 lb. lots.

Metallic Ores

Chrome Ore—Per net ton, f.o.b. eastern shipping points, $21@$24 for 45 to 50 per cent Cr_2O_3 ore. Prices firm and demand good.

Iron Ore—Lake Superior ores, per long ton, lower Lake ports, established season prices:

Mesabi, non-bessemer, 51½ per cent iron, $4.25. Old Range, $4.40.

Mesabi, bessemer, 51½ per cent iron, $4.40. Old Range bessemer, 51½ per cent, $4.55.

High-phosphorus foundry, over 0.18 per cent P, $4.15.

Eastern ores, cents per unit delivered at furnaces: Foundry and basic, 53 to 63 per cent, 9@10½c.

Foreign ores, f.o.b. cars Atlantic ports, cents per unit:

Swedish and Norwegian, low-phosphorus, 68 per cent, 10¼@10¾c.

Spanish low-phosphorus, 52@54 per cent. 10@11c.

Algerian, low-phosphorus, 9¼@9¾c.

Spanish foundry or basic, 50@54 per cent, 8¾@9¼c.

Swedish foundry or basic, 66@68 per cent, 9@9½c.

Manganese Ore—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn 32@35c. Caucasian (washed), 53@55 per cent, 40c., nominal. Production high and takings comparatively small.

[1]Chemical grades, powdered, coarse or fine, 82@87 per cent MnO_2, Brazilian and Cuban, $70@$80 per ton in carloads.

Molybdenum Ore—Per lb. of MoS_2 for 85 per cent MoS_2 concentrates f.o.b. *Colorado*, 50c.@55c.

Tantalum Ore—Foreign, 50c. per lb. of Ta_2O_5 contained, c.i.f. New York, for 65 per cent Ta_2O_5 concentrate.

Tungsten Ore—Per unit of WO_3, N.Y.: Wolframite, $10.50@$10.75; Western scheelite, $10.75@$11.

Uranium Ore—Minimum 5 per cent U_3O_8 per pound of U_3O_8 contained, $5, f.o.b. Montrose, Colo.

Vanadium Ore—Containing 5 per cent V_2O_5, 25c. per lb. of V_2O_5, f.o.b. Montrose, Colo.

Foreign concentrate (lead vanadate) 12 to 18 per cent V_2O_5, 55@60c. per pound V_2O_5, duty paid, seaboard. Nominal.

Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can serve only as a general guide to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can be ascertained only by direct negotiation between buyer and seller.

[1]**Amblygonite**—8@9 per cent lithium oxide, $50@$60 per ton, f.o.b. mines.

Asbestos—F.o.b. *Quebec* mines, tax and bags included, per ton:

Crude No. 1, $525; crude No. 2, $300; spinning fibers, $190; magnesia and compressed sheet fibers, $125@$150; shingle stock, $70; paper stock, $40@$45; cement stock, $25; short fibers, $10@$17.50; floats, $15. Active market for all spinning grades, magnesia fiber and shingle stock. Mine production close to full capacity.

No. 1 Rhodesian crude, $325; No. 2, $250 per ton, c.i.f. New York.

Barytes—F.o.b. mines, per ton, bags extra:

Georgia: Barytes ore, washed, $7.50. Demand steady. Foreign competition keen.

Missouri: Water ground and floated, bleached, $23; $25 in less than car lots, f.o.b. works. Crude ore 93 per cent $BaSO_4$, not to exceed 1 per cent iron, $8, f.o.b. mines. Market firm.

Bauxite—No. 1 chemical ore, over 60 per cent Al_2O_3, less than 5 per cent SiO_2, and less than 2 per cent Fe_2O_3, $8 per long ton, f.o.b. Georgia mines.

Foreign, per metric ton, c.i.f.: Dalmatian, low SiO_2, $5@$6.50; Istrian, $5.50@$7; French, red, $6@$7.50.

Borax—Carload lots, in bags, per lb.; crystals, 5c.; granulated or powdered, 4¾c.; f.o.b. plant, *Pennsylvania*.

[1]**Celestite**—90 per cent $SrSO_4$, finely powdered, $27 per ton in carload lots.

Chalk—Crude, in bulk, per ton c.i.f. New York, $4.75@$5. Few arrivals because of strike in France.

China Clay (Kaolin)—F.o.b. *Virginia* mines, per ton; crude, lump, No. 1, $7; crude No. 2, $5.50; washed, $8; powdered and air-floated, $10@$20; ground, $7@$10.

Florida, pressed pottery, bulk, $13; ground, No. 1, $20; No. 2, $13. Sprayed mineral flour No. 1, $20; No. 2, $17.

1A grades, domestic, $16@$18, f.o.b. *Delaware* plants.

Imported English, f.o.b. American ports: Lumps, $13@$20; powdered, $45@$50.

Diatomite—Per short ton, f.o.b. plant: Kiln-fired brick, $65; kiln-fired aggregate, ¼ in., $45; insulating powder, $30; natural aggregate, ¼ in., $20; air-floated powder, $40. Over 85 per cent silica, 98 per cent through 200 mesh, $14.50@$16 depending on quantity.

Emery — F.o.b. *Pennsylvania* and *New York* in 350-lb. kegs, per lb. Greek Naxos, 6½c.; Turkish, 6½c.; Khasia, 5½c.; domestic, 3½c. Market good.

Feldspar — F.o.b. mine or grinding plant:

North Carolina: No. 1 pottery grade, $6@$6.50 per long ton. Market better.

New Hampshire: Pottery grade, $8 per ton; soap grade, $8.75. Market continues fair.

New York: Per ton, f.o.b. cars, No. 1 crude, $9. Market good.

Tennessee: No. 1 pottery, 140 mesh, $16 per ton; 200 mesh, $18. No. 1 enamel, 140 mesh, $14; 200 mesh, $16. Demand good.

Maine: Pottery grade, ground, $19 per ton. Market good.

Fluorspar—F.o.b. *Kentucky* and *Illinois* mines, per short ton:

Gravel, not less than 85 per cent CaF_2, and not over 5 per cent SiO_2, $18. Foundry lump, 85-5, $20. Ground, 95 to 98 per cent CaF_2, and not over 2½ per cent SiO_2, $32.50 in bulk; $36.50 in bags or barrels. Acid lump, 98-1, $30 in car lots. Market firm; demand good, on buying for winter stocks.

New Mexico: 85-5 gravel, $16; 85-5 lump, $16.50; 93-3 lump, $25; 96-3, ground 100 mesh, $30, bulk; $35 bags. Market strong.

Fuller's Earth—Per ton, f.o.b. *Florida:* 16 to 30 mesh, $16.50; 30 to 60 mesh, $18; 60 to 100 mesh, $15; 100 mesh "up," $8; 200 mesh "up," $15. Market fair at unchanged prices.

Powdered, imported, duty paid, $24@$25 per ton.

Garnet — Domestic, per ton f.o.b. mines, $85.

Spanish grades, $60, c.i.f. port of entry.

Gilsonite—Per ton, carload lots, f.o.b. mines *Colorado:*

Jet asphaltum, $36; selects, $33; seconds (mine run), $25.50.

Graphite—F.o.b. *New York*, per lb.: Ceylon lump, 6@8¾c.; chip, 5@7c.; dust, 3@6c. Madagascar flake, 5½@7c. Market quiet.

Flake, 10@30c. according to grade; fine ground crystalline, 7@12c.; amorphous fine ground graphite, 4@8c. Crude amorphous graphite, $15@$35 per ton according to grade. Market unsettled, Prices lower.

Greensand—Per ton, f.o.b. cars, *New Jersey:* screened and bagged, best grade in carload lots, $30. Trade quiet.

Gypsum—Per ton f.o.b. mill, depending upon location: Crushed, $2.75@$3; ground, $4@$6; agricultural, $6@$12; calcined, $8@$12.

[1]**Ilmenite**—Concentrates, 52 per cent TiO_2, 1½c. per lb., f.o.b. *Virginia* points. $60 per short ton, *Florida* mines.

Iron Oxide (See Ocher)—Standard Spanish red, 2½@4c. per lb.; domestic earth, 2@4½c.

Kaolin—See China Clay.

[1]**Lepidolite**—20@$30 per ton for ordinary grades. Nominal.

Limestone — F.o.b. shipping points, depending on location: either lump or crushed, 90c.@$1.80 per ton.

Agricultural, 75c.@$2 for crushed or pulverized. Prices depend upon source, purity, and fineness.

Magnesite—Per short ton, f.o.b. *California* mines: Grade "A" calcined, 80 per cent through 200 mesh, $45; grade B, $38; dead burned, $33; crude, $14. F.o.b. eastern seaboard, calcined, $40. Market fair.

Mica—F.o.b. plant, per ton:

New Hampshire: Mine run, $360, clean shop scrap, $25; mine scrap, $22. White dry ground, 20 mesh, $30; 40 mesh, $40; 60 mesh, $55; 100 mesh, $70; 200 mesh, $85. Pottery grade, crude, $8; prime quality crude, $8.50. Market fair.

Madagascar, amber, dark, free from iron, per lb., f.o.b. *New York*, duty paid: special grade, $3.25; No. A 1, $2.75; No. 1, $2.50; No. 2, $2.25@$2.50; No. 3, $1.25; No. 4, 65@70c.; No. 5, 40@45c. Grades depend on size of sheets. Good demand for No. 2.

[1]**Monazite**—Minimum 6 per cent ThO_2, $120 per ton.

Ocher—F.o.b. *Georgia* mines, per ton: $22.50@$25 in sacks; $25@$30 in barrels; washed and water floated, $25@$28; second grade, 99 per cent through 225 mesh, $19.

Phosphate—Per long ton, f.a.s. or f.o.b. mines:

Florida, pebble, f.a.s., for export: 76@77 per cent, $7; 75 per cent, $6.25; 74@75 per cent, $6; 70 per cent, $4.50; 68 per cent, $4.10; 66 per cent $4. Firm.

Florida, pebble domestic: 76@77 per cent, $6; 75 per cent, $5.25; 74@75 per cent, $5; 72 per cent, $4; 70 per cent, $3.50. Market fair.

Tennessee, ground, 95 per cent through 100 mesh, basis 65 per cent B.P.L. (tri-calcium phosphate), $8 per short ton, with unit differential of 20c. per ton.

Potash—

	Bags	Bulk
Muriate of potash 80 @ 85 per cent, basis 90 per cent....	34.90	33.65
Sulphate of potash 90@95 per cent, basis 90 per cent....	45.85	44.60
Sulphate of potash-magnesia 48@53 per cent, basis 48 per cent	26.35	25.10
Manure salt 30 per cent....	21.00	18.00
Manure salt 20 per cent....	14.85	11.85
Kainit 14@16 per cent.....	11.75	8.75
Kainit 12.4 per cent.....	11.25..	8.25

Two thousand pounds net weight, c.i.f. Atlantic and Gulf ports. German weights, tares and analyses.

Discounts: 5 per cent on minimum of 50 tons K_2O; 6 per cent on 100 tons; 7 per cent on 300 tons; 10 per cent on 500 tons. Prices guaranteed against sellers' decline until April 30, 1927.

Pumice Stone—In barrels, per lb., powdered, 2½@4c.; selected lumps, 5@7c.; lumps in bags, 3@5c.

Pyrites—Tharsis, per long ton unit of sulphur, c.i.f. U. S. ports; guaranteed 48 per cent sulphur, furnace size, 13¾c. Cinder from ore to remain property of buyers. Market improving and price up ¼c.

[1]**Quartz Rock Crystals**—Colorless, clear and flawed, pieces ¼ to ½ lb. in weight, 40c. per lb. in ton lots. For optical purposes, double above prices.

Silica—Water ground and floated, per ton in bags f.o..b. Illinois: 400 mesh, $31; 350 mesh, $26; 250 mesh, $18.

Glass sand, f.o.b. producing plant, 75c.@$5 per ton; molding sand, 65c.@$2.50; blast sand, $1.35@$4.

[1]**Spodumene**—$20@$30 per ton, depending upon lithium content. Nominal.

Sulphur—$18 per ton for domestic, f.o.b. *Texas* mines; $24 for export, f.a.s. Atlantic ports. Good shipment against contracts. Open prices $1 higher than above. Increase of $2 per ton in export price. Domestic price unchanged.

Talc—Per ton, carload lots, f.o.b. works, containers included:

Vermont: 99 per cent through 200 mesh, extra white, $10.50@$11; 96 per cent through 200 mesh, medium white, $9@$10; packed in 50-lb. paper bags. Demand quiet; prices easier.

New York: Double air-floated, 200 mesh, $13.75; 325 mesh, $14.75. Demand fair.

Georgia: Powdered, gray, $7.50@$10; yellow, $9@$12; red, $11@$13; roofing, $7.50@$9. Market fair.

New Jersey: Soapstone, ground, $10@$12; market fair.

Tripoli—Per short ton, burlap bags, paper liners, minimum carload 30 tons, f.o.b. *Missouri:* Once ground through 40 mesh: rose and cream colored, $14. Double ground through 110 mesh: rose and cream, $17. Air-floated through 200 mesh: rose and cream, $25; mill run, $15. Usual good fall business. Price on 40-mesh cut from $16 to $14.

[1]**Zircon**—Freight allowed east of Mississippi River; 95 per cent, 3c. per lb., f.o.b. mines, in carload lots.

Mineral Products

Arsenious Oxide (white arsenic)—3¼c. per lb. London, £13@£13¼ per long ton.

Calcium Molybdate—$1.20 per lb. of contained Mo, delivered.

Copper Sulphate—4.90c. per lb. for either large or small crystals.

Sodium Nitrate—Spot, crude $2.40 per 100 lb. ex vessel, Atlantic ports. Futures, $2.44@$2.53.

Sodium Sulphate (Salt Cake)—Per ton, bulk, f.o.b. works, $20@$22.

Zinc Oxide—Per lb. in bags, in car lots: Lead-free, 7¼c.; 10, 20 or 35 per cent leaded grades, 7½c.; French, red seal, 10½c.

Ferro-Alloys

[1]**Ferrocerium**—Per lb., $5.50.

Ferrochrome—1@2 per cent carbon, 23c. per lb. of contained chromium; 4 to 6 per cent carbon, 11½c. per lb. of contained chromium, delivered on contracts, freight allowed east of Mississippi River. Spot prices 12@12½c. per lb. Market active.

Ferromanganese — Domestic, 78@82 per cent, $88@$90 per gross ton furnace, prompt and future. British product held at $100, seaboard. Spiegeleisen, 19@21 per cent, $32@$34 f.o.b. furnace; 16@19 per cent, $31@$33.

Ferrophosphorus—Electrolytic, 18 per cent P, $91 per ton; 24 per cent, $122.50; f.o.b. *Alabama* and *Tennessee*.

Ferrosilicon—Per gross ton, f.o.b. works, freight allowed east of Mississippi River: 50 per cent, $87.50 for spot, delivered in carload lots; $85 on contract. 75 per cent, $150 for spot; 14@16 per cent, $45. Active market.

Ferrotitanium—For 15 to 18 per cent material, $200 per ton, f.o.b. Niagara Falls, N. Y.

Ferrotungsten—$1@$1.05 per lb. of W contained f.o.b. works.

[1]**Ferro-uranium**—30 to 40 per cent U, $4.50 per lb. of U contained, f.o.b. works in 500-lb. lots.

Ferrovanadium—Per lb. of V contained, f.o.b. works, $3.40@$4, depending on grade, for spot; $3.25 @$3.75 on contract.

Metal Products

Rolled Copper—Sheets, 23c.; wire, 16¼c. per lb., f.o.b. mill.

Lead Sheets—Full rolled, 12½c. per lb.; clipped, 12½c.

Nickel Silver—30c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal — Dimension sheets, 20¾c. per lb.; rods, 17¾c. per lb.

Zinc Sheets—11¾c. per lb., f.o.b. works.

Refractories

Chrome Brick—$45 per net ton, f.o.b. shipping point.

Fireclay Brick—First quality, $40@$43 per M., Ohio, Kentucky, Central Pennsylvania; second quality, $35@$40.

Magnesite Brick—9-in. straights, $65 per net ton, f.o.b. works.

Silica Brick—$40 per M. Pennsylvania and Ohio; $49@$52 Alabama and Illinois.

[1]**Zirkite**—Powdered, 80 per cent ZrO_2, 2½c. per lb. Brick, straights, 80c.@$1 each.

[1]Price furnished by Foote Mineral Co., Philadelphia.

Metal Statistics

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1925	1926	1925	1926	1925	1926
January	68.447	67.795	32.197	31.322	477.702	485.295
February	68.472	66.773	32.245	30.797	476.886	485.852
March	67.808	65.880	31.935	30.299	477.279	485.606
April	66.899	64.409	31.372	29.682	479.034	485.702
May	67.580	65.075	31.276	30.125	484.960	485.485
June	69.106	65.481	31.863	30.248	485.553	486.000
July	69.442	64.793	31.954	29.861	485.514	485.755
August	70.240	62.380	32.268	28.773	485.264	485.293
September	71.570	60.580	32.983	27.904	484.270	484.845
October	71.106	.....	32.972	.....	483.909	.....
November	69.223	.....	32.155	.....	484.201	.....
December	68.889	.....	31.835	.....	484.538	.....
Year	69.065	.....	32.088	.....	482.426	.....

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York		London			
	Electrolytic		Standard		Electrolytic	
	1925	1926	1925	1926	1925	1926
January	14.709	13.822	66.065	59.013	70.607	65.325
February	14.463	13.999	64.714	59.669	69.525	66.375
March	14.004	13.859	62.892	58.603	67.739	65.489
April	13.252	13.706	60.575	57.200	64.194	64.600
May	13.347	13.599	60.131	56.494	63.560	64.313
June	13.399	13.656	59.899	56.778	63.369	64.591
July	13.946	13.924	61.467	57.864	65.750	65.625
August	14.490	14.174	61.613	58.857	68.169	66.857
September	14.376	14.062	61.886	58.705	67.693	66.528
October	14.300	.....	61.977	.....	67.523	.....
November	14.353	.....	61.280	.....	67.893	.....
December	13.866	.....	59.540	.....	65.625	.....
Year	14.042	.....	61.920	.....	66.804	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London		
	1925	1926	1925	1926	1925	1926	1926 3 M
January	10.169	9.255	9.953	9.102	41.443	34.778	34.584
February	9.428	9.154	9.126	8.991	37.944	33.903	33.903
March	8.914	8.386	8.578	8.165	36.804	31.625	31.921
April	8.005	7.971	7.662	7.764	32.791	28.775	29.284
May	7.985	7.751	7.780	7.538	32.283	28.253	28.731
June	8.321	8.033	8.024	7.876	33.479	29.986	30.142
July	8.151	8.499	8.054	8.383	34.698	31.716	31.545
August	9.192	8.908	9.284	8.722	38.188	32.756	32.345
September	9.508	8.786	9.303	8.515	38.884	32.085	31.790
October	9.513	.....	9.299	.....	39.017	.....	.....
November	9.739	.....	9.578	.....	36.872	.....	.....
December	9.310	.....	9.157	.....	34.739	.....	.....
Year	9.020	.....	8.817	.....	36.429	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Tin

	New York				London	
	99%		Straits			
	1925	1926	1925	1926	1925	1926
January	57.692	61.415	58.250	2.275	265.560	282.038
February	56.517	62.653	57.068	63.705	262.181	287.107
March	53.038	63.472	53.733	64.505	245.682	292.288
April	51.380	61.962	52.135	63.389	237.006	281.388
May	53.675	60.165	54.620	62.305	245.476	270.125
June	54.885	58.409	55.957	60.611	252.476	268.352
July	56.683	61.365	58.014	63.091	258.435	282.102
August	56.649	63.875	58.190	65.260	258.538	293.690
September	56.405	66.535	58.247	68.895	259.182	306.273
October	60.462	.....	62.274	.....	277.722	.....
November	62.136	.....	63.304	.....	284.506	.....
December	61.952	.....	62.928	.....	284.920	.....
Year	56.790	.....	57.893	.....	260.974	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Zinc

	St. Louis		London		
	1925	1926	1925 Spot	1926	1926 3 M
January	7.738	8.304	37.917	38.059	37.363
February	7.480	7.759	36.528	36.053	35.956
March	7.319	7.332	35.741	34.090	34.247
April	6.985	7.001	34.644	32.503	32.863
May	6.951	6.821	34.223	32.038	32.413
June	6.990	7.112	34.149	33.244	33.398
July	7.206	7.411	34.894	34.045	34.270
August	7.576	7.376	36.691	34.173	34.524
September	7.753	7.413	37.435	34.389	34.415
October	8.282	.....	39.884	.....	.....
November	8.614	.....	39.039	.....	.....
December	8.565	.....	38.327	.....	.....
Year	7.622	.....	36.624	.....	.....

St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) Refined New York		Platinum (c) Crude New York
	1925	1926	1925	1926	1925	1926	1926
January	17.428	23.490	81.596	87.960	117.000	118.200	113.20
February	19.795	21.676	79.386	87.580	117.000	113.909	108.341
March	15.553	19.708	80.481	88.194	117.000	112.000	106.278
April	12.553	17.462	82.327	89.769	118.269	111.538	103.731
May	15.770	12.170	81.360	91.365	119.850	108.960	102.900
June	16.500	11.106	83.154	91.346	120.000	111.000	106.615
July	17.779	14.490	83.077	90.163	120.000	114.692	109.000
August	17.683	15.957	82.317	89.260	120.000	116.000	108.692
September	17.143	15.325	81.730	91.425	120.000	116.840	108.600
October	18.029	.....	83.856	.....	120.000	.....	.....
November	20.000	.....	88.250	.....	120.000	.....	.....
December	21.692	.....	90.000	.....	120.000	.....	.....
Year	17.494	.....	83.128	.....	119.093	.....	.....

(a) Antimony quotations in cents per pound for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1925	1926	1925	1926	1925	1926
January	24.66	22.76	23.76	21.76	23.76	22.26
February	24.50	22.76	23.26	21.76	23.76	22.26
March	24.06	22.76	23.06	21.76	22.91	22.26
April	22.89	21.38	21.76	20.66	22.26	21.05
May	21.57	21.12	20.26	19.76	21.16	20.76
June	20.76	20.76	19.76	19.76	20.11	19.80
July	20.76	20.44	19.76	19.26	20.26	19.49
August	20.76	19.87	19.76	19.18	20.26	19.26
September	21.04	20.11	20.03	19.26	20.50	19.30
October	21.50	.....	20.37	.....	20.83	.....
November	22.64	.....	21.58	.....	22.08	.....
December	22.76	.....	21.76	.....	22.26	.....
Year	22.33	.....	21.26	.....	21.68	.....

In dollars per long ton.

Monthly Crude Copper Output in Short Tons

Domestic

	1926					
	March	April	May	June	July	August
Alaska shipments	3,150	3,597	1,797	4,059	2,838	3,093
Butte & Superior	1,243†	.....	.....	892†	.....	.....
Calumet & Arizona	2,010	1,938	2,454	2,104	1,666	1,960
Magma	1,255	1,200	1,228	1,208	1,345	1,315
Miami	2,336	2,302	2,298	2,241	2,200	2,447
New Cornelia	3,641	3,634	2,723	3,543	3,466	3,194
Nevada Con.	9,774†	.....	.....	27,539†	.....	.....
Old Dominion	1,111	1,132	1,173	1,058	985	1,350
Phelps Dodge	7,440	7,033	7,566	6,786	6,775	6,723
Ray Con.	17,840†	.....	.....	(a)	.....	.....
United Verde Extension	1,784	1,730	1,997	1,908	1,738	1,765
Utah Copper	26,736†	.....	.....	26,890†	.....	.....
Tennessee Copper	543	520	555	521	543	511

Foreign

Boleo, Mexico	898	910	935	1,008	1,106	1,124
Furukawa, Japan	1,586	1,708	1,513	1,323	1,526	.....
Granby Cons., Canada	1,763	1,583	1,700	1,390	1,777	1,805
Union Minière, Africa	7,097	7,050	7,547	7,294	7,716	8,188
Mount Lyell, Aust.	2,002†	.....	.....	1,695†	.....	.....
Sumitomo, Japan	.....	.....	1,219	1,364	.....	.....

†Three months. (a) Included in Nevada Con.

Monthly Production of Primary Copper from U. S. Mines and Daily Rate (Short Tons)

	1924		1925		1926	
	Monthly Production	Daily Rate	Monthly Production	Daily Rate	Monthly Production	Daily Rate
January	66,631	2,149	74,789	2,412	71,026	2,291
February	65,681	2,265	68,967	2,463	68,131	2,433
March	65,181	2,102	74,901	2,416	75,728	2,443
April	66,073	2,202	70,667	2,356	73,454	2,448
May	65,608	2,116	70,574	2,276	73,542	2,372
June	63,933	2,131	59,894	2,330	71,317	2,377
July	64,787	2,090	68,507	2,210	72,228	2,330
August	66,756	2,153	68,090	2,196	72,221	2,330
September	63,800	2,127	67,720	2,272	.....	.....
October	68,989	2,225	71,042	2,292	.....	.....
November	68,291	2,276	67,400	2,247	.....	.....
December	67,647	2,182	69,566	2,244	.....	.....
Total	793,377	.....	842,117	.....	577,647	.....
Monthly average	66,115	.....	70,176	.....	72,206	.....
Average of daily rate	.....	2,168	.....	2,307	.....	2,377

Imports and Exports of Ores and Metals in August, 1925 and 1926

Compiled from U. S. Department of Commerce Records

In pounds unless otherwise stated

Imports

	August, 1925	August, 1926
Antimony		
Ore.. Gross weight	.....	551,375
Ore.. Antimony content	.....	307,213
Liquated regulus or metal	3,016,590	2,279,839
Copper		
Ore	8,955,924	7,114,408
Concentrates	3,849,587	1,581,753
Regulus, coarse metal, cement copper	165,011	.....
Imported from:		
Spain	664,275	456,792
Canada	3,912,199	4,460,971
Mexico	2,376,736	1,379,817
Cuba	1,818,880	.....
Chile	3,789,040	2,310,084
Peru	56,663	50,065
Other countries	352,729	38,432
Unrefined black, blister and converter copper in pigs, bars and other forms	46,618,905	28,977,298
Imported from:		
Spain	5,094,264	1,034,412
United Kingdom	2,243,275	.....
Canada	5,811,119	4,683,058
Mexico	6,189,758	4,144,938
Chile	2,256,982	285,366
Peru	13,240,588	5,949,251
Portuguese Africa	10,713,948	3,459,036
Other countries	1,068,971	9,421,237
Refined copper	7,707,045	10,156,776
Old and clippings for remanufacture	989,918	965,761
Composition metal, copper chief value	22,758	80,247
Brass		
Old and clippings for remanufacture	1,090,995	891,708
Lead		
Ore and matte	10,219,950	9,672,937
Bullion or base bullion	9,134,796	8,707,641
Pigs and bars	21,068	2,147,511
Scrap lead, babbitt metal, solder, and other forms	91,880	147,426
Type metal and antimonial lead... Gross weight	.....	.....
Type metal and antimonial lead... Lead content	.....	.....
Manganese ore, tons Gross weight	.....	264,338
Manganese ore, tons Manganese content	.....	193,45
Pyrites, tons	19,455	11,849
Tin		
Ores, tons	1	45
Bars, blocks, and pigs	17,353,524	11,495,065
Imported from:		
United Kingdom	5,048,109	2,341,832
British Malaya	10,790,579	8,013,216
Hongkong	190,482	22,534
Dutch East Indies	223,735	175,562
Australia	100,800	100,800
Other countries	999,819	841,121
Zinc		
Ore, zinc content.. Dutiable	3,432,260	310,691
Ore, zinc content.. Free	230	.....
Blocks, pigs, and old	10,759	434

Exports

	August, 1925	August, 1926
Copper		
Ores, concentrates, composition metal, and unrefined	11,265	2,002,454
Refined in ingots, bars, and other forms	68,863,722	69,206,223
Exported to		
Belgium	6,737,317	7,621,775
France	6,905,809	10,762,913
Germany	15,918,674	15,841,970
Italy	12,614,400	6,760,252
Netherlands	6,191,373	8,889,258
Spain	886,453	235,329
Sweden	2,269,484	706,454
United Kingdom	14,093,388	11,206,910
Other Europe	370,995	742,124
Canada	1,630,599	511,353
China	224,000	1,702,850
Japan	1,064,066	4,044,395
Other countries	46,854	180,660
Old and scrap	690,943	1,482,550
Pipes and tubes	432,541	209,751
Plates and sheets	786,352	387,251
Rods	4,990,156	3,302,727
Wire	805,540	894,476
Insulated copper wire and cable	1,679,849	1,792,646
Lead		
In pigs, bars and other forms		
From domestic ore	1,717,036	47,180
From foreign ore	15,118,155	11,406,476
Exported to:		
Belgium	672,092	224,034
France	2,307,526	448,089
Germany	4,640,272	2,912,917
Italy	590,129	.....
Netherlands	.....	224,048
United Kingdom	6,160,619	2,353,159
Other Europe	336,049	896,248
Brazil	458,960	.....
Other South America	980,439	199,909
Japan	112,028	2,744,889
Other countries	557,077	1,450,363
Other lead manufactures	1,003,429	1,981,536
Zinc		
Ore and concentrates, tons	9,323	6,141
Dross	3,205,497	1,111,104
Cast in slabs, blocks, or pigs	9,862,128	7,903,965
Exported to		
Belgium	223,973	168,000
France	1,176,287	1,008,339
Germany	608,252	713,992
Italy	2,038,555	1,008,561
Netherlands	235,173	90,253
United Kingdom	4,477,601	3,193,516
Other Europe	179,219	440
Argentina	448,239	.....
British India	403,360	.....
Other countries	71,469	1,720,864
Sheets, strips, other forms	986,792	658,857
Dust	303,716	201,902
Other zinc manufactures	44,907	218,401

A. S. & R. Half-Year Income Increased by $2,500,000

The following table is a summary of the consolidated income and profit and loss surplus account of the American Smelting and Refining Co. and subsidiaries for the first half of 1926 and a comparison with the same period in 1925:

	Half Year Ended June 30, 1926	Half Year Ended June 30, 1925
Net earnings of mines, smelting, refining and manufacturing plants	$14,346,277.12	$11,909,796.33
Other income—net:		
Interest, dividends received, commissions, etc	740,621.47	582,751.17
Net earnings, before deducting general and administrative expenses and corporate taxes	$15,086,898.59	$12,492,547.50
Deduct		
General and administrative expenses	$713,712.60	$663,265.90
Research and examination expenses	74,019.57	117,967.37
Corporate taxes (including estimated U. S. and Mexican income taxes)	1,212,161.96	897,315.03
Total to deduct	$1,999,894.13	$1,678,548.30
Net income from current operations, before providing for bond interest, depreciation, obsolescence and depletion, and after providing for all taxes	$13,087,004.46	$10,813,999.20
Deduct		
Interest on First Mortgage bonds outstanding with public:		
Series "A" 5%	$1,002,812.37	$1,010,935.46
Series "B" 6%	285,574.19	284,905.14
Depreciation and obsolescence	2,016,508.85	2,066,690.00
Ore depletion	927,253.60	1,072,552.36
Total to deduct	$4,232,149.01	$4,435,082.96
Net income	$8,854,855.45	$6,378,916.24
Deduct		
Dividends on:		
Preferred stock	$1,750,000.00	$1,750,000.00
Common stock	2,134,930.00	1,829,940.00
Total to deduct	$3,884,930.00	$3,579,940.00
Surplus income for period	$4,969,925.45	$2,798,976.24

Summary of consolidated profit and loss surplus account:

Balance at beginning of year	$19,511,423.17
Surplus income for period, after deducting dividends	4,969,925.45
Balance at June 30, 1926	$24,481,348.62

U. S. Smelting Earned $2,480,866 in Eight Months

The United States Smelting, Refining & Mining Co. reports for eight months ended Aug. 31, 1926, consolidated net profit of $2,480,866 after interest, depreciation, depletion and amortization. This compares with $2,426,755 in first eight months of 1925.

Consolidated income account for eight months ended Aug. 31, 1926, compares as follows:

	1926	1925	1924
Profit after interest	$4,068,834	$4,280,150	$3,252,883
Depreciation, depletion and amortization	1,587,968	1,853,395	1,431,773
Net profit	$2,480,866	$2,426,755	$1,821,110
Preferred dividends	1,134,817	1,134,817	1,134,816
Surplus	$1,346,049	$1,291,938	$686,294

At the Nome fields, in Alaska, two of the dredges were started in June and the other two dredges were started in July, these dates being later than may be expected for future operations. Returns indicate good prospects.

Mining Stocks—Week Ended October 2, 1926

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	50½	48⅜	49¼	Oc.16, No.22 Q	0.75
Arcadian Consol.	Boston	....	....	*90	....	....
Ariz. Com'l	Boston	11⅛	10	10¼	Jy. 16, Jy. 30	0.50
Calaveras	N. Y. Curb	....	....	1¼	....	....
Calumet & Arizona	New York	69½	66½	69⅝	Se. 4, Se. 20 Q	1.50
Calumet & Hecla	Boston	17¾	17¼	17¼	Au.31, Se.15	0.50
Cerro de Pasco	New York	66⅜	63¼	65¼	Jy. 15, Au.2, Q	1.00
Chile Copper	New York	33⅝	32⅜	33⅝	Se.1, Se.27, Q	0.62½
Con. Coppermines	N. Y. Curb	3	2⅝	3	....	....
Copper Range	Boston	16½	15¼	15⅞	May, 1925	1.00
Crystal Copper	Boston Curb	*49	*37	*44	....	....
East Butte	Boston	3⅛	2⅜	3	Dec., 1919	0.50
First National	Boston Curb	*12	*12	*12	Feb., 1919	0.15
Franklin	Boston	*40	*40	*40	....	....
Granby Consol.	New York	32⅛	30½	31¼	May, 1919	1.25
Greene-Cananea	New York	21⅛	19¾	21	Nov., 1920	0.50
Hancock	Boston	....	....	1	....	....
Howe Sound	New York	43⅞	42	42	Oc.1, Oc.15 Q	1.00
Inspiration Consl.	New York	25	24⅛	24⅜	Se.16, Oc.4, Q	0.50
Iron Cap	Boston Curb	3⅝	3	3	....	....
Isle Royale	Boston	12⅜	11⅛	11⅛	Jn. 1, Jn. 15	0.50
Jerome Verde Dev.	N. Y. Curb	*51	*49	*51	....	....
Kennecott	New York	61⅛	55⅞	60⅜	Sept. 3, Oct. 1 Q	1.00
Lake Copper	Boston	*80	*80	*80	June, 1925	0.50
Magma Copper	New York	39⅜	38⅛	38⅞	Oc.1, Oc. 15, Q	0.75
Mason Valley	N. Y. Curb	2⅜	2	2	....	....
Mass Consolidated	Boston	*40	*30	*30	Nov., 1917	1.00
Miami Copper	New York	17⅜	16¼	17¼	Aug.2, Aug.16 Q	0.25
Mohawk	Boston	41⅜	40	41⅜	Jy.31, Se.1 Q	1.00
Mother Lode Coa.	New York	5⅞	5⅜	5⅞	Jn. 15, Jn. 30	0.37½
Nevada Consol.	New York	15⅜	13⅝	14⅞	Oc.14, Nov.16	0.25
New Cornelia	Boston	22⅜	22	22⅜	Au 6, Au.23 Q	0.40
North Butte	Boston	3⅜	3	3⅜	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*50	*50	*50	Se. 1, Se. 15	0.05
Old Dominion	Boston	17⅛	17	17	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†137	†134	....	Se.25, Oc.2 Q	1.50
Quincy	Boston	21⅛	19½	20	Mar., 1920	1.00
Ray Consolidated	New York	15⅜	14	15⅛	Ap.20, Ap.30	0.25
Ray Hercules	N. Y. Curb	....	....	11⅞	....	....
St. Mary's Min. Ld.	Boston	28½	27¼	28¼	Ap.17, My.18	2.00
Seneca Copper	New York	5⅜	5	5	....	....
Shannon	Boston	*40	*40	*40	Nov., 1917	0.25
Shattuck-Denn	Boston Curb	6½	6¼	6¼	....	....
Superior & Boston	Boston	*50	*25	*40	....	....
Tenn. C. & C.	New York	12¼	11⅛	12	Au.31, Se.15, Q	0.25
United Verde Ex.	N. Y. Curb	26	25½	26	Oc.16, No. 1, Q	0.75
Utah Copper	New York	106½	104⅜	106½	Se.3, Se.17 Q	1.75
Utah Metal & T.	Boston	2¼	1¾	1¾	Dec., 1917	0.30
Victoria	Boston	*50	*50	*50	....	....
Walker Mining	Salt Lake	*59	*55	*55	....	....
NICKEL-COPPER						
Internat. Nickel	New York	37¼	35⅛	37	Se.7, Se.30, Q	0.50
Internat. Nickel, pfd.	New York	...	...	102	Jy.12, Au.12,	1.50
LEAD						
Gladstone M. M. Co.	Spokane	*33½	*31	*31	Sept., 1926	0.005
National Lead	New York	158	155	158	Jn. 11, Jn. 30 Q	2.00
National Lead pfd.	New York	....	....	116⅜	My.21, Je.15 Q	1.75
St. Joseph Lead	New York	42	40⅜	41	Sept. QX	0.75
ZINC						
Am. Z. L. & S.	New York	6⅞	6½	6½	May., 1917	1.00
Am. Z. L. & S, pfd.	New York	32⅛	32⅛	32⅛	Nov., 1920	1.50
Butte C. & Z.	New York	4⅜	4⅜	4⅜	De.10, De.24	0.50
Butte & Superior	New York	10¼	9⅞	10⅛	Se.15, Se.30 Q	0.50
Callahan Zn-Ld	New York	2	1⅞	1⅞	Dec., 1920	0.50
Eagle-Picher	Cincinnati	30⅜	30⅛	30⅛	Au.14, Se.1 Q	0.40
Eagle-Picher, pfd.	Cincinnati	....	....	110	Se. 30, Oc. 5 Q	1.50
New Jersey Zn.	N. Y. Curb	....	....	191	July 20, Aug. 10 Q	2.00
United Zinc	N. Y. Curb	....	....	*70	....	....
Yellow Pine	Los Angeles	*25	*15	*15	Dec. 1925 Q	0.04
GOLD						
Alaska Juneau	New York	1⅜	1⅛	1⅛	....	....
Argonaut	Toronto	*38	*32½	*38	....	....
Barry-Hollinger	Toronto	*69½	*62½	*69	....	....
Carson Hill	Boston	....	....	*25	....	....
Consol. W. Dome L.	Toronto	*22	*21	*21½	....	....
Cresson Consol. G.	N. Y. Curb	2⅜	2⅜	2⅜	July, 1926	0.10
Crown Reserve	Toronto	*9⅞	*8⅛	*8⅛	Jan., 1917	0.05
Dome Mines	New York	11	10⅛	10⅜	Se.20, Oc. 30, Q	0.50
Golden Center	N. Y. Curb	2⅛	1⅜	1⅞	....	....
Golden Cycle	Colo. Springs	....	....	2	Dec., 1925	0.03
Hollinger Consol.	Toronto	19.30	19.00	19.10	Se.21, Oc. 7 Q	0.10
Homestake Mining	New York	60	59½	60	Se.20, Se.25 M	0.50
Kirkland Lake	Toronto	1.09	*98⅞	1.01	....	....
Lake Shore	Toronto	14.10	13.50	14.10	Se.1, Se. 15 Q	0.10
McIntyre-Porcupine	New York	24¾	24⅜	24⅜	Au.2, Se.1 Q	0.25
Newray	Toronto	*37	*37	*37	....	....
Noranda	N. Y. Curb	18⅜	17⅞	18⅛	....	....
Night Hawk Pen.	Toronto	*7	*7	*7	....	....
Portland	Colo. Springs	....	....	*43	Oc.6, Oc.15	0.02
Rand Mines	New York	41⅞	39⅜	41⅞	Au.23–30	Am.Sh. 1.52
Teck-Hughes	Toronto	4.75	4.44	4.73	Jy. 15, Au. 2	0.05
Tom Reed	Los Angeles	*60	*55	*55	Ma.10 Ma.20	0.02
Tough-Oakes	Toronto	*44	*40	*42	....	....
United Eastern	N. Y. Curb	*59	*50	*58	July, 1924	0.05
Vipond Cons.	Toronto	1.72	1.69	1.70	....	....
Wright-Hargreaves	Toronto	8.75	8.60	8.69	Se.15, Oc.1 QX	0.07½
Yukon-Alaska Trust	N. Y. Curb	20	20	20	....	....
GOLD AND SILVER						
Carnegie Metals	Boston	15	12	14⅜	....	....
Con. Cortez	N. Y. Curb	...	...	*7	....	....
Con. Virginia	San Francisco	*8½	*6½	*6¾	....	....
Continental Mines	N. Y. Curb	....	....	*48	....	....
Dolores Esperanza	N. Y. Curb	*86	*75	*75	July, 1923	0.05
Premier Gold	N. Y. Curb	...	...	2⅛	Se.15, Oc.4 Q	0.08
Tonopah Belmont	N. Y. Curb	3	2⅞	2⅞	Se.15, Oc.1	0.05
Tonopah Extension	N. Y. Curb	*30	*30	*30	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	4⅜	4⅛	4⅛	Se.30, Oc.27 Q	0.07½
Unity Gold	N. Y. Curb	....	....	*30	....	....
West End Consol.	N. Y. Curb	....	....	*18	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	....	....	*27	June, 1918	0.02

Stock	Exch.	High	Low	Last		Last Div.
SILVER						
Alvarado	N. Y. Curb	....	....	1	Oct., 1920	0.50
Beaver Consol.	Toronto	*90	*85	*87	May. 1920	0.03
Castle-Trethewey	Toronto	1.39	1.15	1.28	....	....
Coniagas	Toronto	4.25	4.25	4.25	May, 1924	0.12½
Keeley	Toronto	1.65	1.50	1.55	Se. 1, Se.15 SA	0.12
Kerr Lake	N. Y. Curb	1.00	*99	*99	Oc.1, Oc.15	0.12½
La Rose	Toronto	*7½	*7¼	*7¼	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	*55	*50	*55	Jy. 2, Jy. 15	0.05
McKinley-Dar.-Sav.	Toronto	*11¼	*10	*10¼	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.51	3.05	3.25	Jy.1, Jy.15 Q	0.12½
Nipissing	N. Y. Curb	6	5½	5⅝	Se.30, Oc.20 Q	0.15
Temiskaming	Toronto	*11	*10	*10	Jan., 1920	0.40
SILVER-LEAD						
Ahumada	New York	7⅝	7	7	Se.28, Oc.1, QX	0.25
Alta Merger	Salt Lake	*4	*2	....	....	....
Bingham Mines	Boston	40⅜	37	37	Se.20, Se.30 Q	1.00
Cardiff M. & M.	Salt Lake	....	....	*34	Nov., 1924	0.10
Chief Consol.	Salt Lake	2.95	2.90	2.90	Jy.10, Au.10 Q	0.10
Consti'n Mng. & Mill'g	Spokane	*60	*50	*60	....	....
Emma Silver	Salt Lake	†1	†*50	....	....	....
Erupcion	Boston Curb	1⅛	1 1/16	1⅛	Se., Oc.1, QX	0.15
Federal M. & S.	New York	86½	80	86½	....	....
Federal M. & S., pfd.	New York	75½	73½	73½	Au.25, Se.15 Q	1.75
Hawthorne Mines	N. Y. Curb	*15	*11	*15	....	....
Hecla Mining	N. Y. Curb	17⅞	17⅞	17⅞	Au.14, Se.15 Q	0.50
Highland—Surprise	Spokane	*21	*18½	*21	....	....
Iron King Mining	Salt Lake	*30	*23½	*23½	....	....
Keystone Mining	Salt Lake	....	....	*26	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*16	*16	*16	....	....
Lucky-Tiger Com.	Kansas City	†100½	†101	....	Se.10, Se.20 X	0.07
Mammoth Mining	Salt Lake	2.90	2.75	2.75	Mar.24, Apr. 1	0.10
Marsh Mines	Spokane	2.25	2.12½	2.12½	Se.15, Oc.19	0.15
Park Utah	New York	5.75	5.10	5.60	Se.15, Oc.1 Q	0.15
Plutus Mining	Salt Lake	1.90	1.90	1.90	July 15	0.15
Prince Cons.	Salt Lake	3	3	3	....	....
Silver King Coal	Salt Lake	7.60	6.90	7.25	Se. 20, Oc.1,	0.25
Silversmith	Spokane	*50	*48	*48	Jn.30, Jy.10 Q	0.02
Strattons Mines	Spokane	*41	*40	*41	....	....
Tamarack-Custer	Spokane	*27	*26	*26	Sept., 1924	0.25
Tintic Standard	Salt Lake	11.62½	9.75	10.75	Se.13, Se.25 QX	0.40
Utah-Apex	Boston	6⅞	6¼	6⅜	Oc.3, Oc.15 Q	0.25
Western Utah Copper	N. Y. Curb	....	....	*5	....	....
IRON						
Bethlehem Steel	New York	50½	48⅝	49½	July, 1924	1.25
Cleveland-Cliffs Iron	Cleveland	82	80	80	Oct., 1926	1.00
Colorado Fuel & Iron	New York	49⅜	44⅛	48⅛	May, 1921	0.75
Gt. North'n Iron Ore	New York	20	19¾	20	Dec., 1925	0.75
Inland Steel	New York	41⅜	41	41⅜	Au.13, Se.1 Q	0.62½
Mesabi Iron	N. Y. Curb	...	...	1⅛	....	....
Replogle Steel	New York	9⅞	9⅜	9⅞	....	....
Republic I. & S.	New York	60	58½	60	Au.14, Se.1	1.00
Republic I. & S. pfd.	New York	96¾	96½	96½	Se.15, Oc.1 Q	1.75
Sloss-Sheffield S. & I.	New York	133	125½	133	Se.10, Se.20 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	106	106	106	Se.20, Oc.1 Q	1.75
U. S. Steel	New York	154⅜	147⅜	153¼	Se.2, Se.29 Q	1.75
U. S. Steel pfd	New York	128	126¼	128	Au.3, Au.30, Q	1.75
Virginia I. C. & C.	New York	48⅛	48	48⅛	Jan., 1924	1.50
Virginia I.C.&C.pfd	New York	...	...	72	Jn.1, July 2,	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM						
De Beers Consol	New York	...	...	38	Ju.16, Ju.17	1.70
So. Am. Gold & P.	N. Y. Curb	4⅜	4⅛	4⅜	....	....
Alum. Co. of Amer.	N.Y. Curb	75	71½	73	....	....
Alum. Co. of Amer pf.	N.Y. Curb	...	...	69	June 15, July 1, Q	1.50
Vanadium Corp.	New York	40	39	39	Au.2, Au.16, Q	0.75
ASBESTOS						
Asbestos Corp., New	Montreal	23⅛	21	21⅔	Jan., 1926	1.50
Asbestos Corp., pfd.	Montreal	79½	77	78	Jy.1, Jy.15, SA	1.75
SULPHUR						
Freeport Texas	New York	30½	27	30⅔	Nov., 1919	1.00
Texas Gulf	New York	184	178	183	Se.7, Se. 15, Q	3.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	49	47	47⅞	Au.20, Se. 1, Q	1.00
Amer. Metal pfd	New York	...	...	114	Au.21, Se. 1 Q	1.75
Amer. Sm. & Ref.	New York	142	135⅝	139⅝	Jy.10, Au.2, Q	1.75
Amer. Sm.&Ref.pfd.	New York	119½	119	119½	Au.7, Se.1, Q	1.75
Consol. M. & S.	N. Y. Curb	...	...	300	Jn.30, Jy.5 SAX	3.75
Federated Metals	N. Y. Curb	12½	12½	12½	....	....
Newmont Mining	N. Y. Curb	76	69	76	Oc.1, Oc.15,	0.60
Southwest Metals	N. Y. Curb	....	....	1	....	....
U. S. Sm. R. & M.	New York	36⅜	33⅛	35⅜	Oc.7, Oc.15, Q	0.87½
U. S. Sm. R.&M.pfd.	New York	48⅝	47½	47½	Oc.7, Oc.15, Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Henry Sachs, Colorado Springs, Colo.

PRICE WEEK ENDED SEPT. 21, 1926

Name	High	Low	Last	Last Divd. Date	Amount
Aramayo Mines (25 frs.)	83/3	80/4½	81/3	Aug. 1926	15 p.c.†
British Platinum (£1)	3/4½	2/9	3/—	Feb. 1925	2½ p.c.
Burma Corpn. (10 rupees)	16/4½	15/7½	15/9	Aug. 1926	7 annas*
Bwana M'Kubwa (5s)	7/3	6/6	6/7½	....	....
Camp Bird (2s)	4/7½	3/6	3/6	....	....
El Oro (£1)	7/3	6/9	7/3	Nov. 1924	2½ p.c.*
Esperanza (10s)	1/—	—/9	—/9	....	....
Frontino & Bolivia (£1)	8/6	8/3	8/6	July 1926	2½ p.c.
Mexican Corpn. (£1)	13/6	12/4½	12/6	....	....
Mexico Mines of El Oro (£1)	25/10½	23/9	25/—	June 1926	7½ p.c.*
Oroville Dredging (£1)	3/9	3/6	3/9	Dec. 1923	3¾ p.c.
Ouro Preto (£1)	2/3	2/—	2/3	May 1925	2½ p.c.
Rhodesian Congo Border (£1)	121/10½	108/9	120/—	....	....
St. John del Rey (£1)	8/6	8/3	8/6	June 1925	6½ p.c.
San Francisco Mines (10s)	34/6	33/3	34/6	June 1926	15 p.c.
Santa Gertrudis (£1)	17/10½	16/3	16/9	July 1926	5 p.c.
Selukwe (2s. 6d.)	13/3	12/3	13/1½	April 1917	6¾ p.c.
S. Amer. Copper (2s.)	4/3	4/—	4/—	Nov. 1917	75 p.c.
Tanganyika (£1)	54/1½	46/3	48/1½	Aug. 1926	7½ p.c.
Tomboy (£1)	3/9	3/3	3/6	July 1926	10 p.c.
Union Miniere du Haut-Katanga (Brussels)	9.900	9.890	9.900	July 1926	175 (‡)

* Free of British income tax. † Swiss frs. ‡ Belgian frs.